15 JUNE 1961

CONVENTION NUMBER

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ELECTRICAL TIMES

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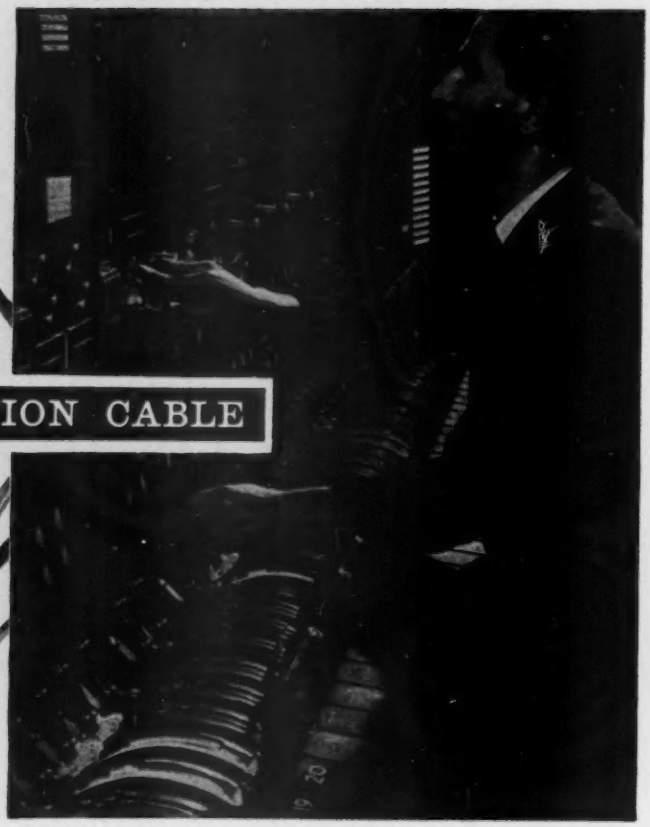
Photograph by courtesy of British Railways



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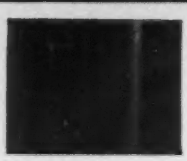

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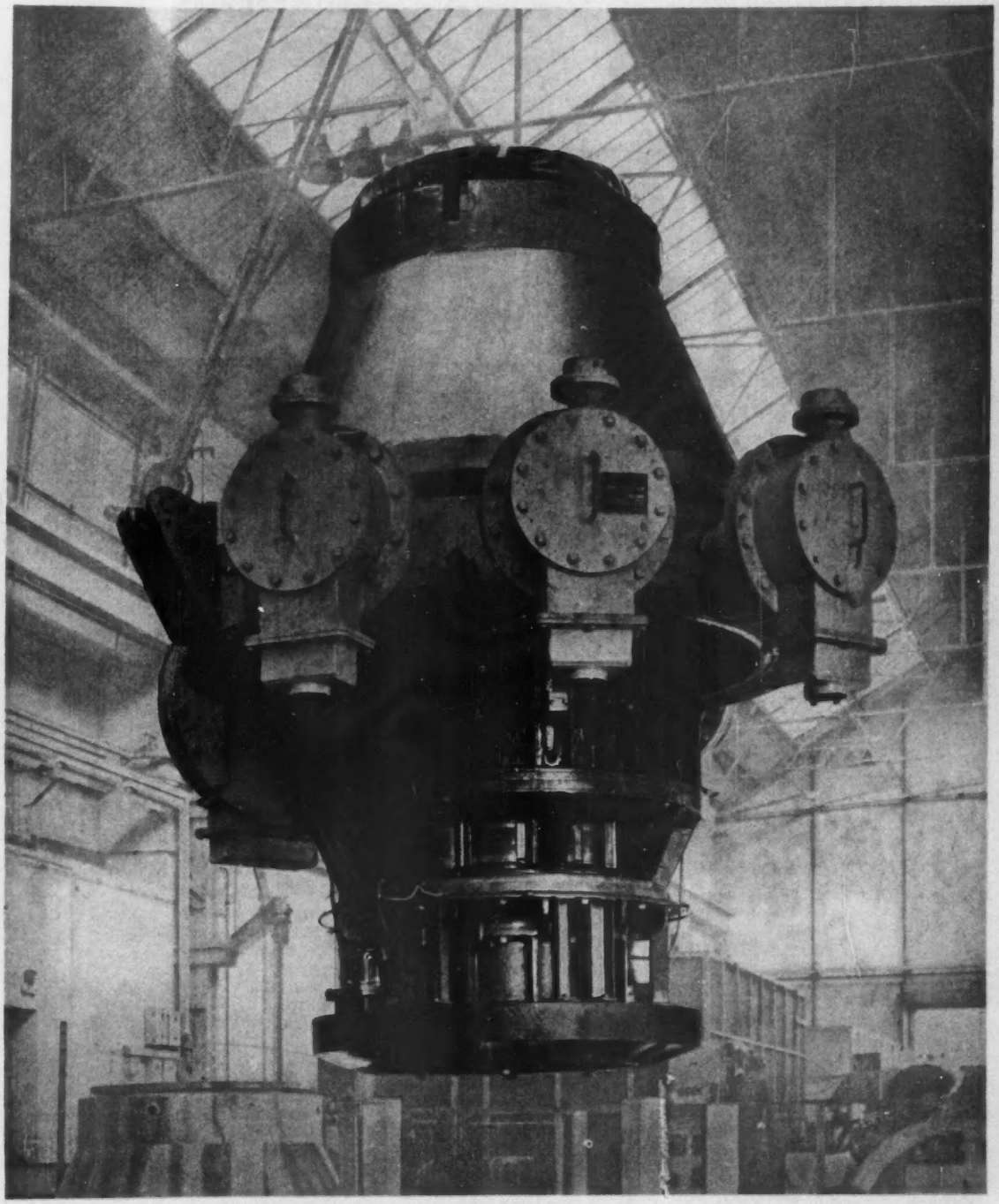

For the Windscale Advanced Gas-cooled Reactor

One of the four L.S.E. 1570 h.p., 2970 r.p.m. motors for driving the CO_2 circulators of the Windscale Advanced Gas-cooled Reactor. The motors are contained in the pressure circuit and operate in carbon dioxide at the full circuit pressure. The design provides for any necessary maintenance to be carried out without depressurization of the main gas circuit.

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The photograph shows the motor before attachment of the pressure bell. (Impellers made by James Howden & Co. Ltd.)

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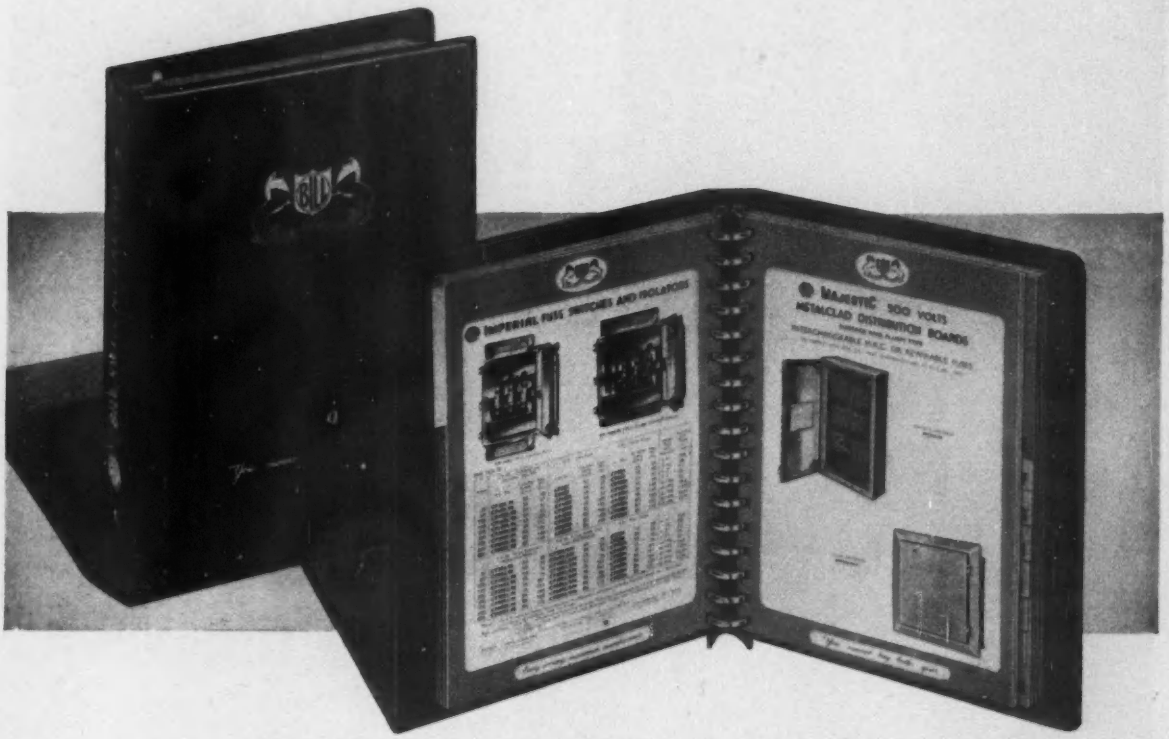

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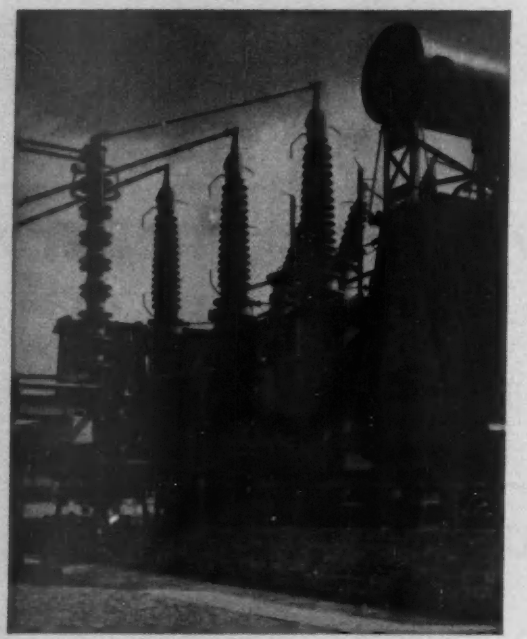
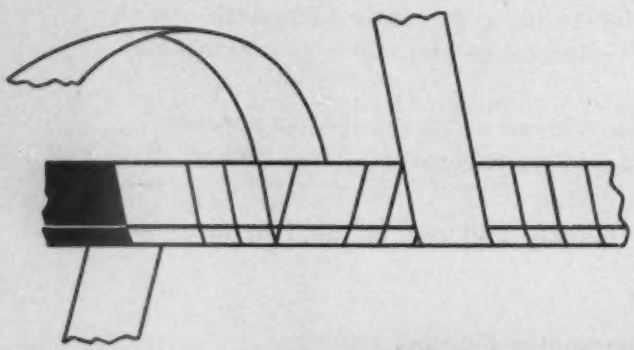


Engineers use the word performance in two senses, a limited one which refers to parameters that can be specified and checked; and a wider, vaguer, but essentially more realistic sense which covers freedom from trouble, ease of servicing, adaptability and many other things. Performance in the first sense is reproducible by any competent manufacturer; it depends on designing to well-established principles. Performance in the second sense is the basis of choice between manufacturers. It comes from countless small differences in design that are based on . . .

This thing called know-how



Know-how shows up most clearly in detail. Often a very small detail. Take, for example, the lapping of the paper insulation of a transformer winding. We have learned how vital it is that the paper should be so lapped that no subsequent handling can disturb it. To this end we use narrow paper—never wider than ¾ in.—and instead of butting the edges of each turn we overlap half the width. Alternate layers or sets of layers are wound in the opposite lay. This gives us a remarkably solid wrapping, though it takes considerably longer to do. Finally, conductors intended for heavy multiple-conductor, spiral windings are served with a layer of cotton over the paper covering to provide mechanical protection. It is attention to details such as these that gives our transformers their enviable reputation for reliability.

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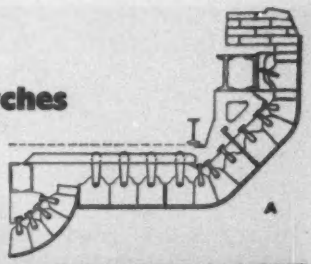

Unless the heavy fouling of heat transfer surfaces resulting from the use of the low-grade boiler fuels (due to mechanisation) can be dealt with speedily, and systematically without shut down, boiler availability is kept substantially below the optimum. Similarly, replacement of defective refractories can be the cause of major disturbance of production schedules and this time-cost must be kept to the minimum. IVOR have the answer to both of these problems—sootblowing equipment covering the widest range of applications and their Pendulum Suspended Refractory Arches which allow the quickest possible renewal of worn areas without major dismantling. Write to our engineers about both these essential auxiliaries.

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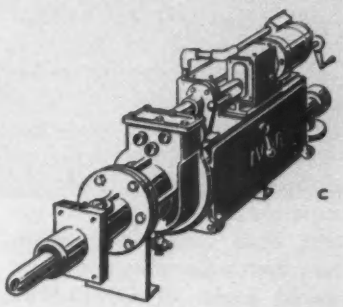
A. *Typical furnace arch applicationof Ivor Pendulum method of suspending Ivor Refractory Tiles. (Top)*
B *A long, retractable lance type Ivor sootblower installed on the Superheater Section of a power station boiler. (Centre)*
C. *This is an Ivor Valve-in-head Gun-type sootblower for power stations and large industrial boilers.*



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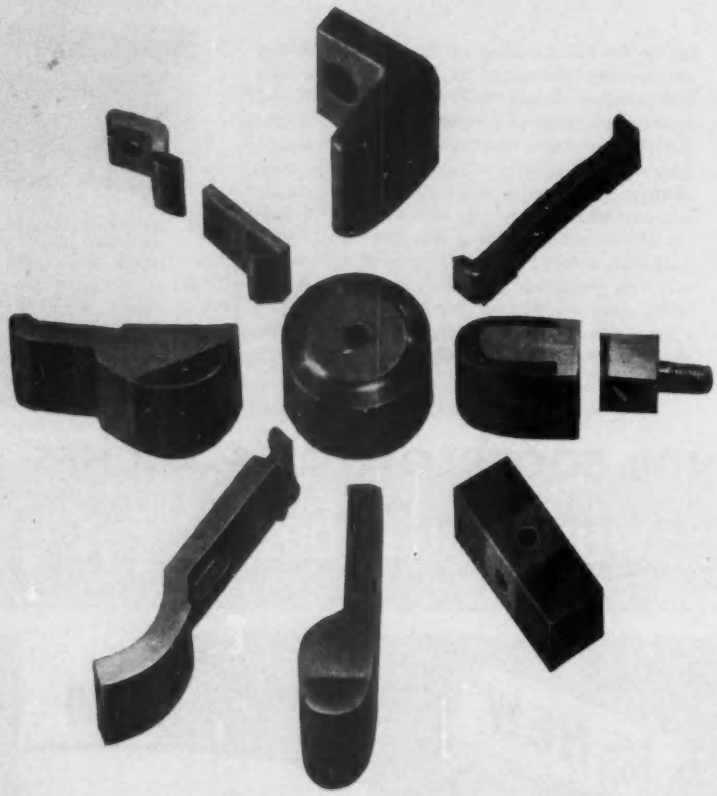

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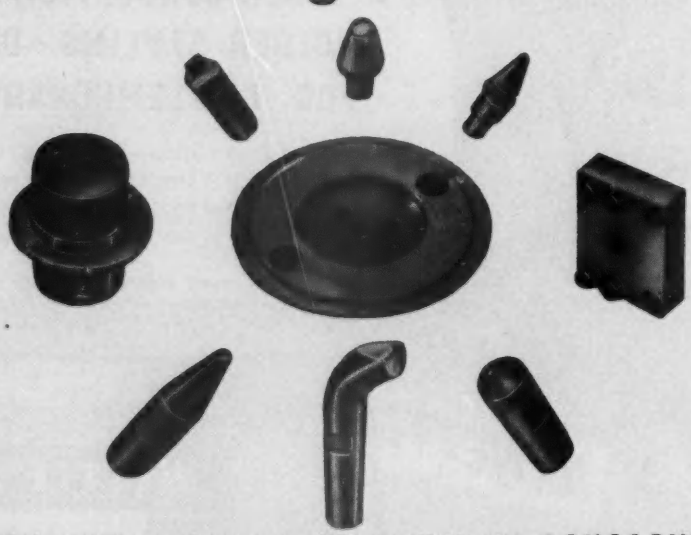

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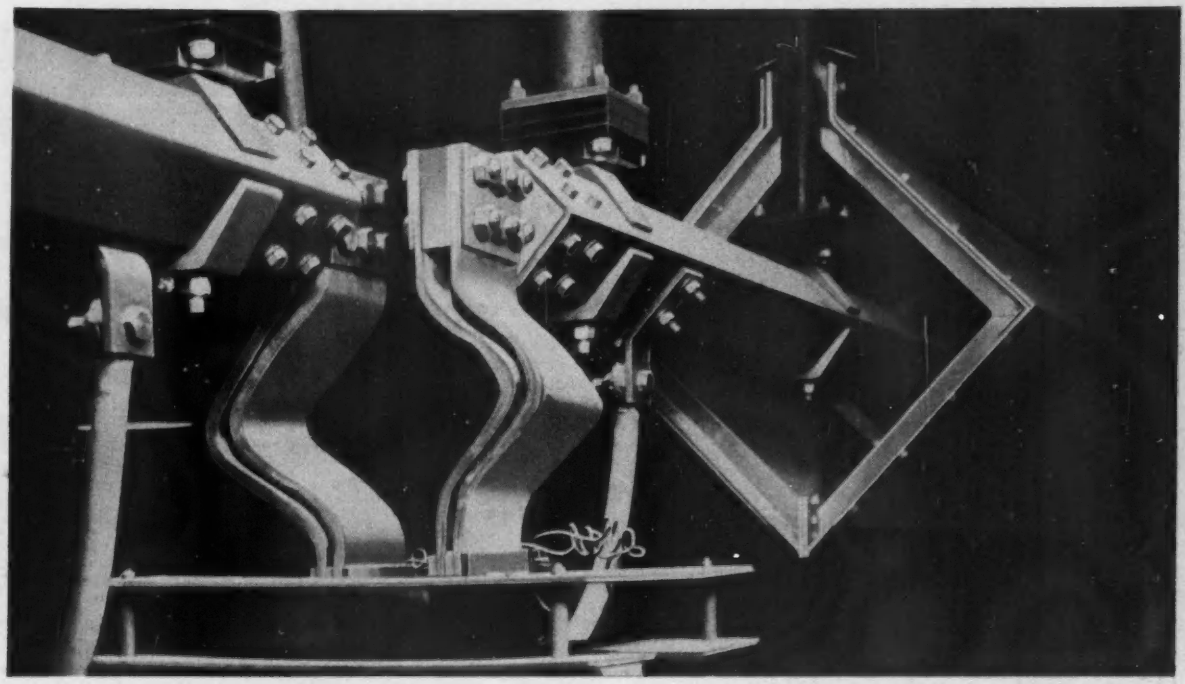

A.C. Current Busbar installation using double angle conductors, showing flexible connections to current transformers. Designed and installed by E. R. M.

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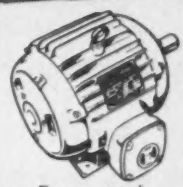
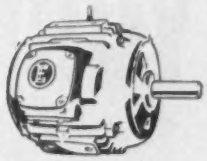
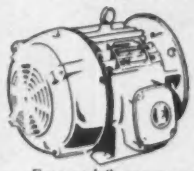


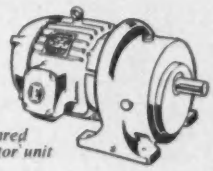
Foot mounted



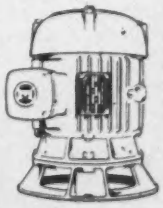
Pad fixing



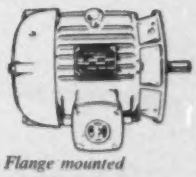
Foot and flange mounted



Geared motor unit



Skirt mounted



Flange mounted

Lint-free cowl

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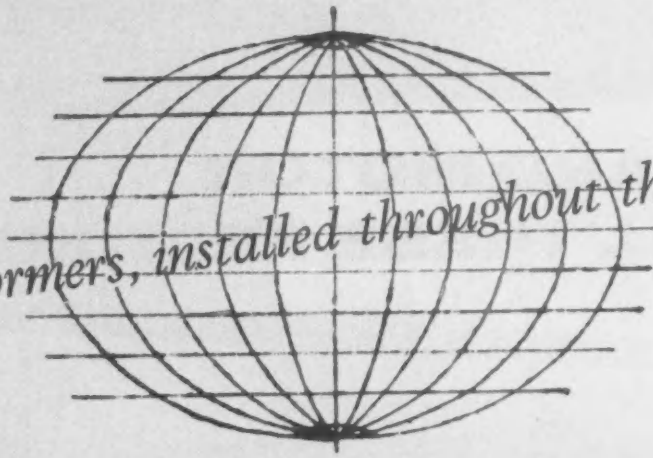

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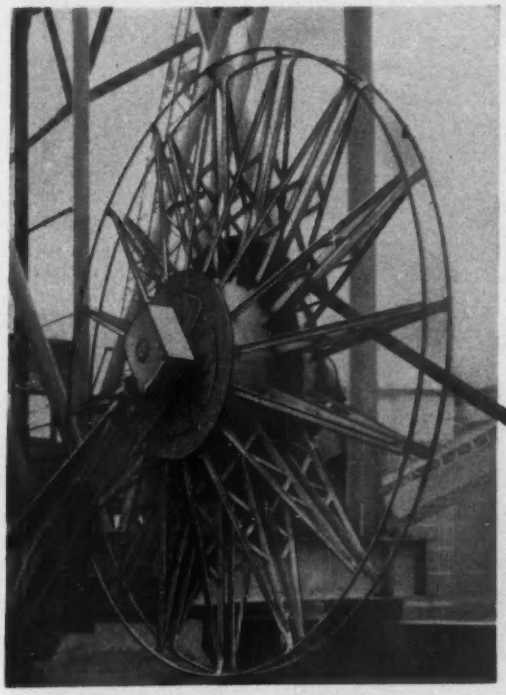

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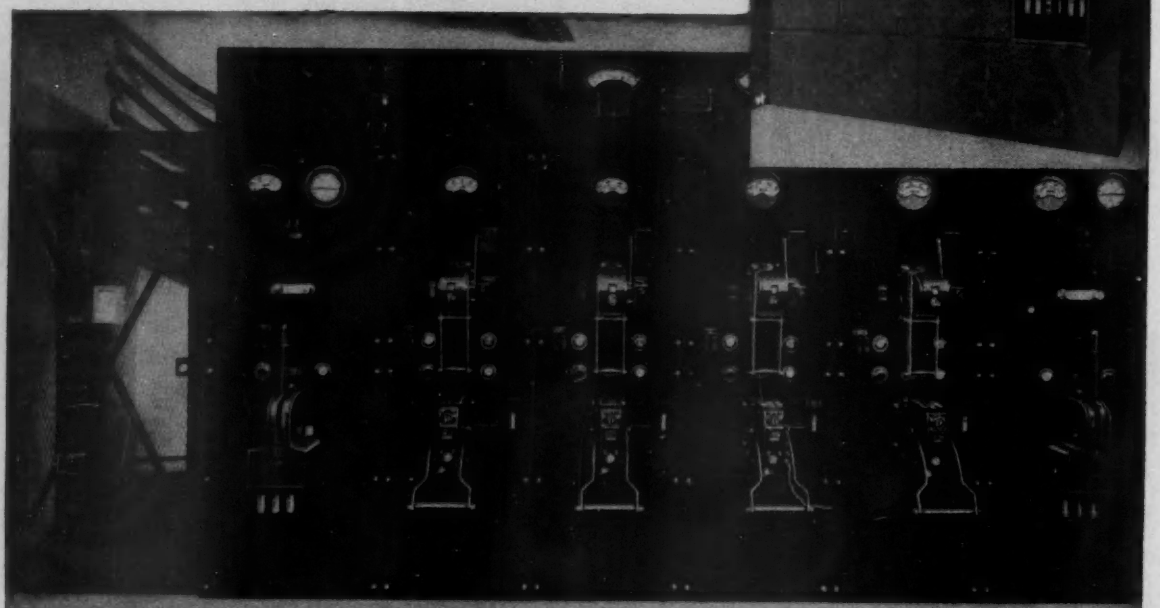

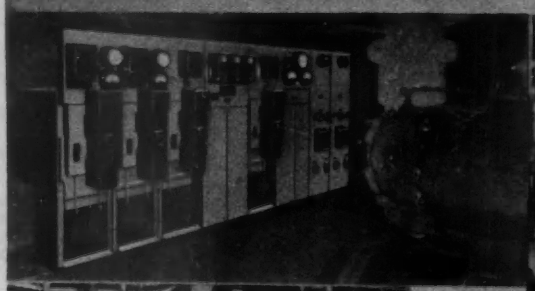

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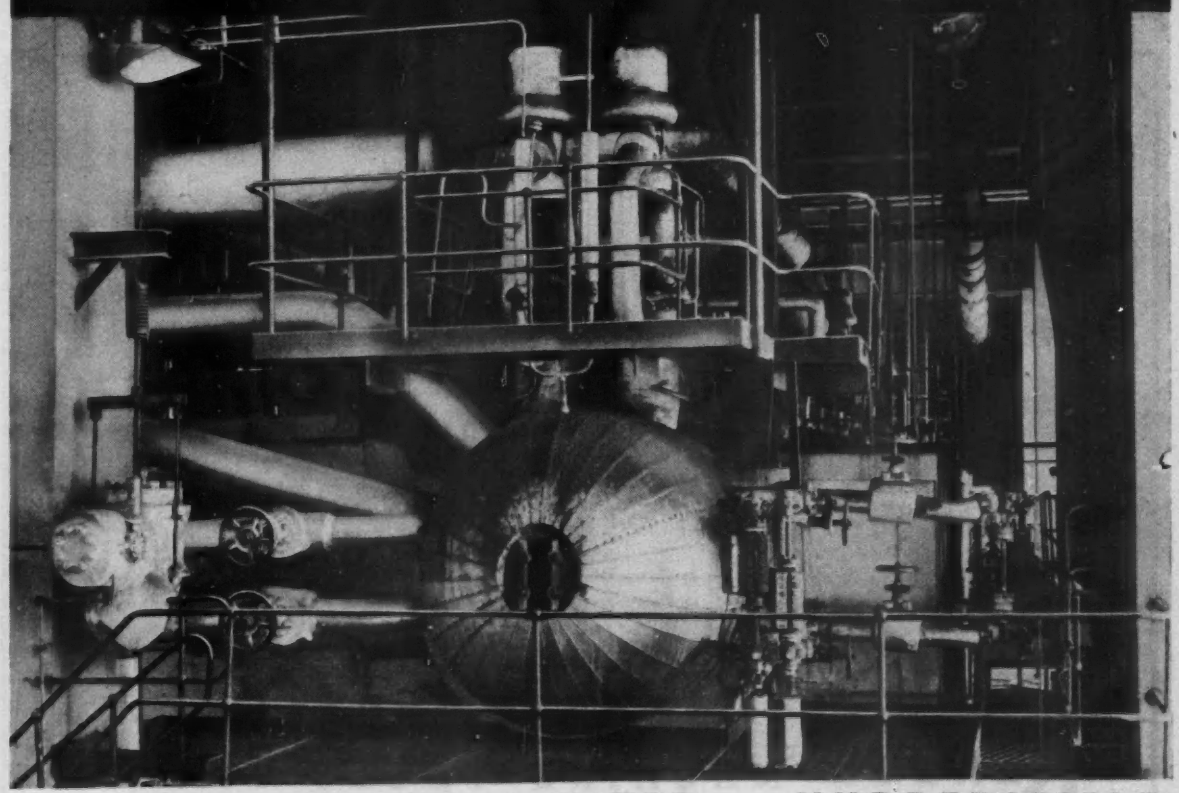

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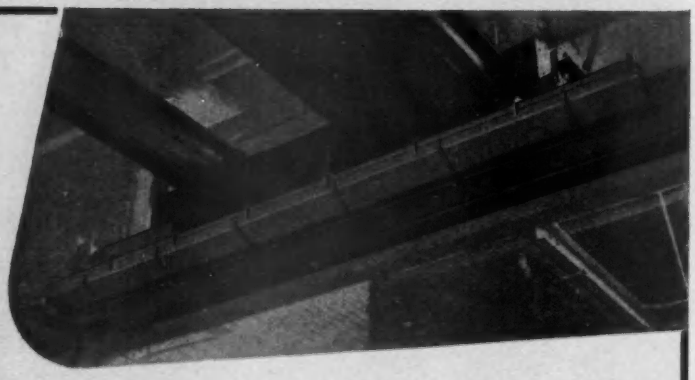

Manguard

SAFETY SUPPLY SYSTEM
(Patent No. 861073)

PRINCIPLE

The principle of Manguard is the provision of a set of flexible bar collectors on the crane and electrically protected contact boxes at intervals along the crane track connected by insulated cable.

SAFETY FEATURES

- Contact box spacing ensures an electrical supply to the crane at all times.
- Each contact box has its own contactor ensuring that the contact studs are alive only when in contact with the crane collector bars.
- The crane collector box is fabricated in fibreglass. The four contact bars are bedded in flexible polyurethane, giving long life and minimum maintenance.
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- MANGUARD equipment may be fitted to existing cranes.

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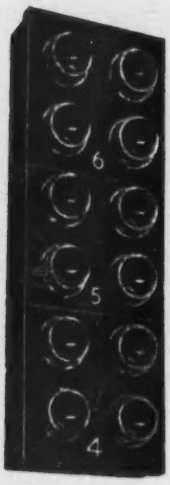

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MULTI-LIGHT UNITS

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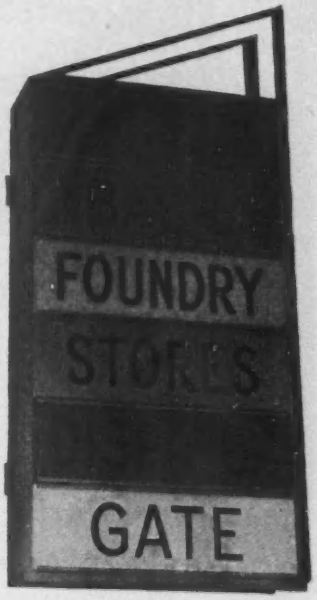

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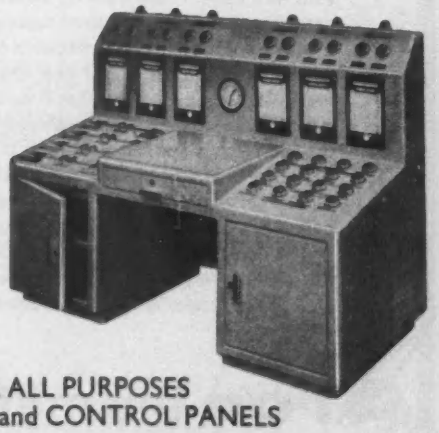

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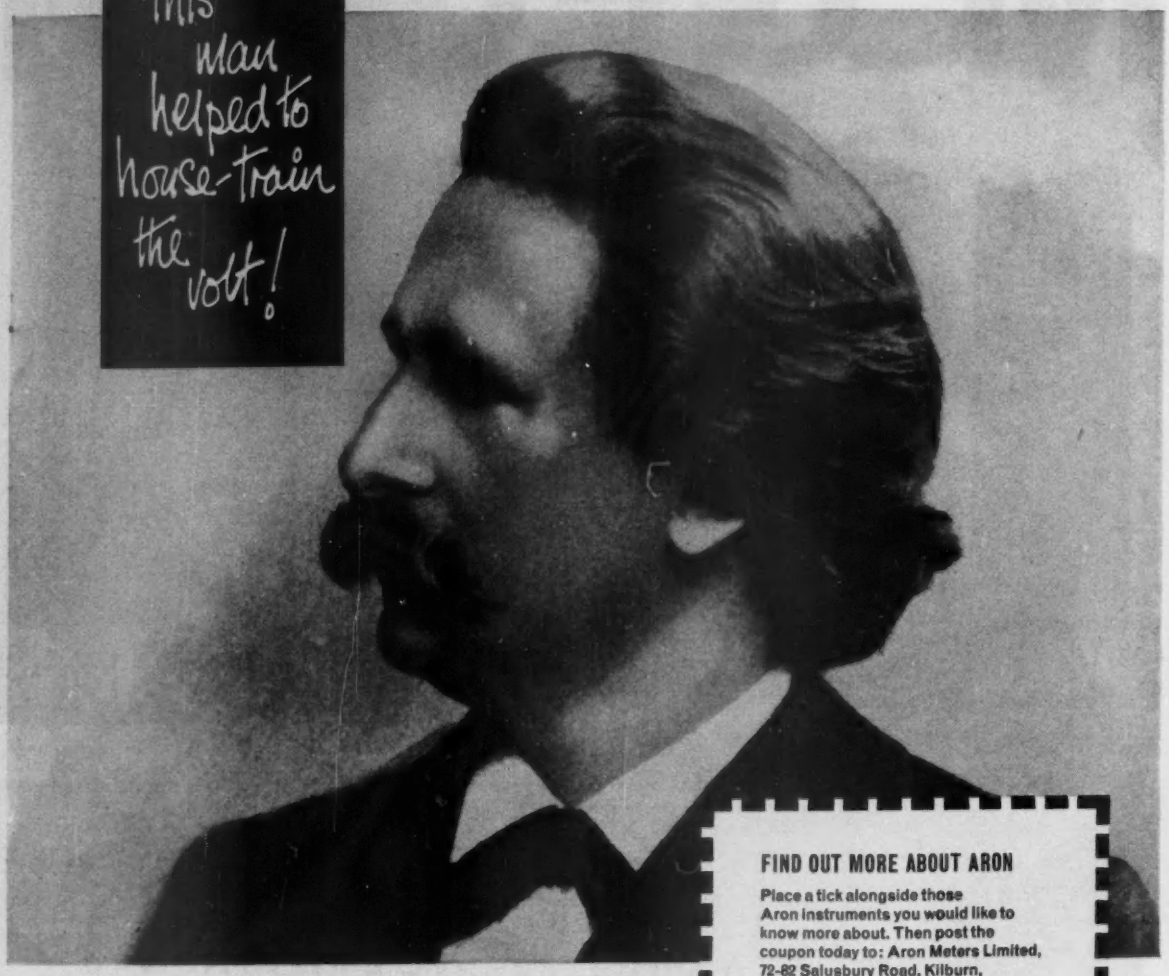
WILLIAM McGEOCH & CO. LTD., (Dept. T.E.), BORDESLEY, BIRMINGHAM 10



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TO THE DESIGN ENGINEER we offer modern design and research facilities backed by years of specialised element production.

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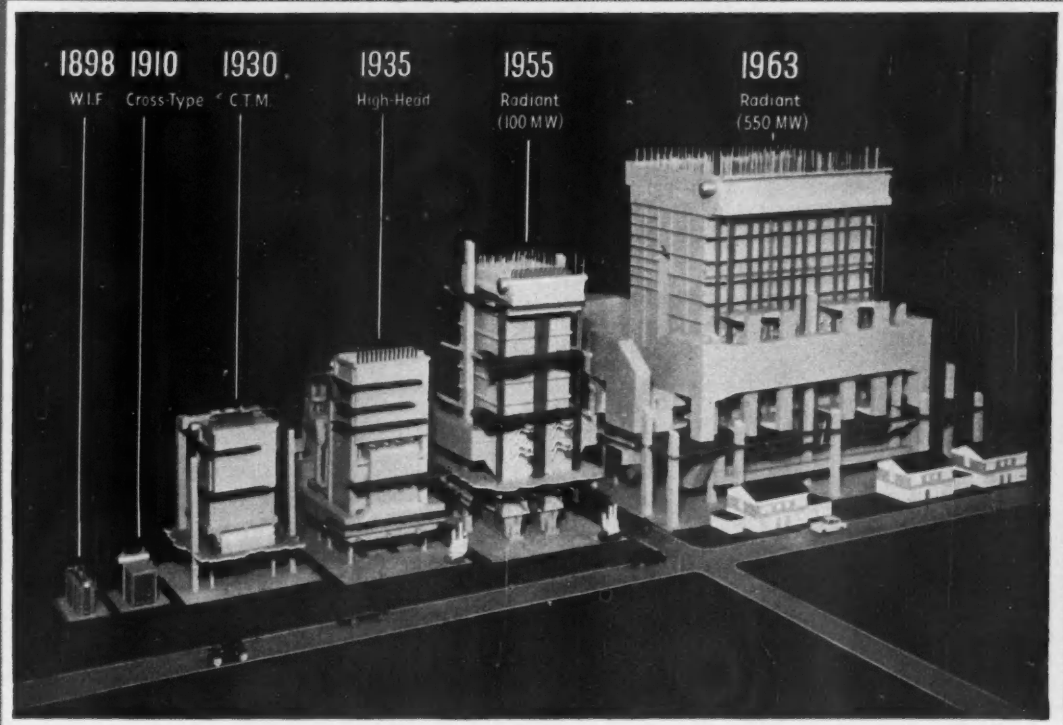

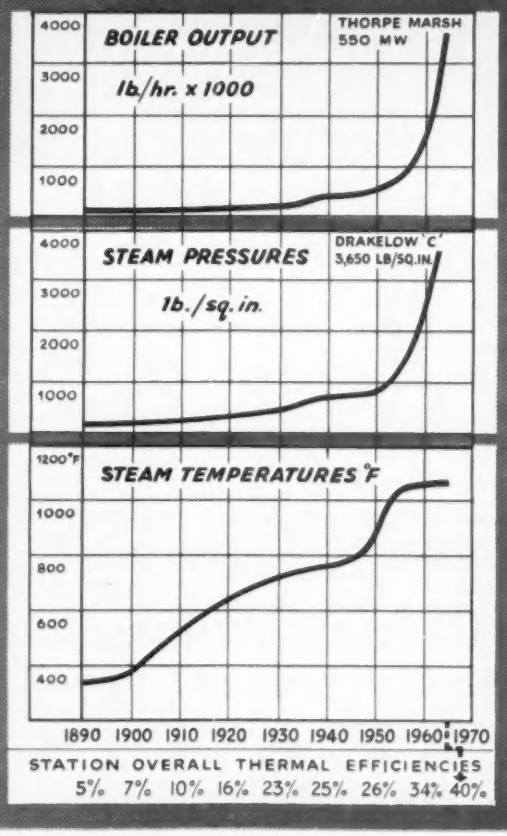

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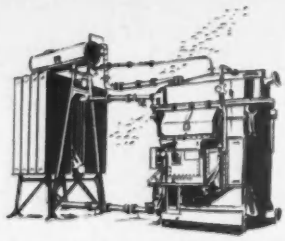

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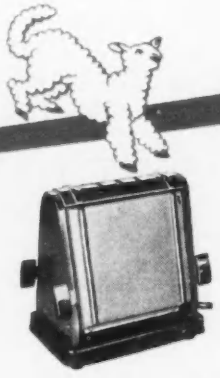

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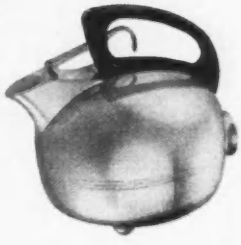

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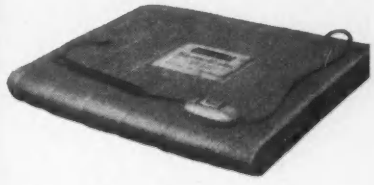
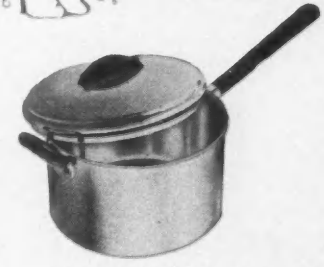


BLANKETS



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For Electric Cookers

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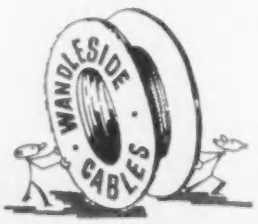

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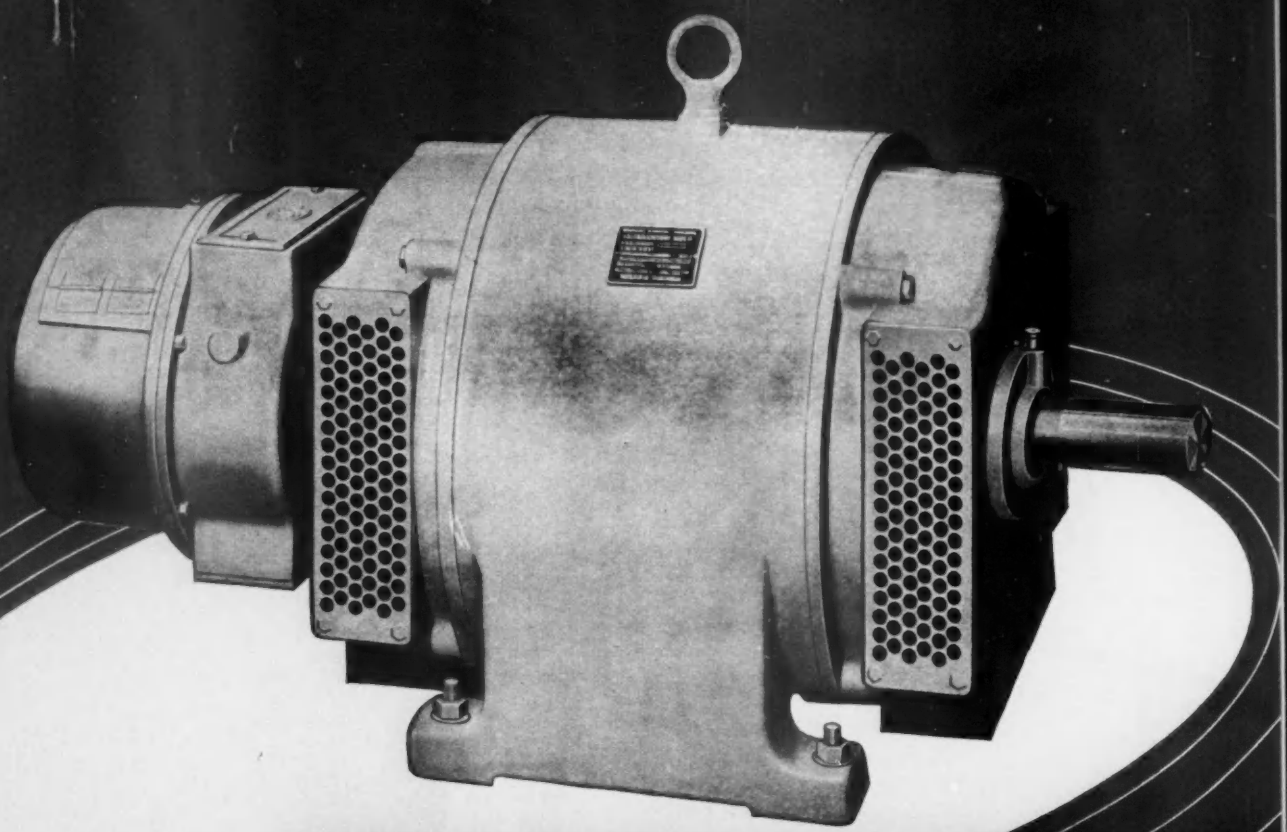

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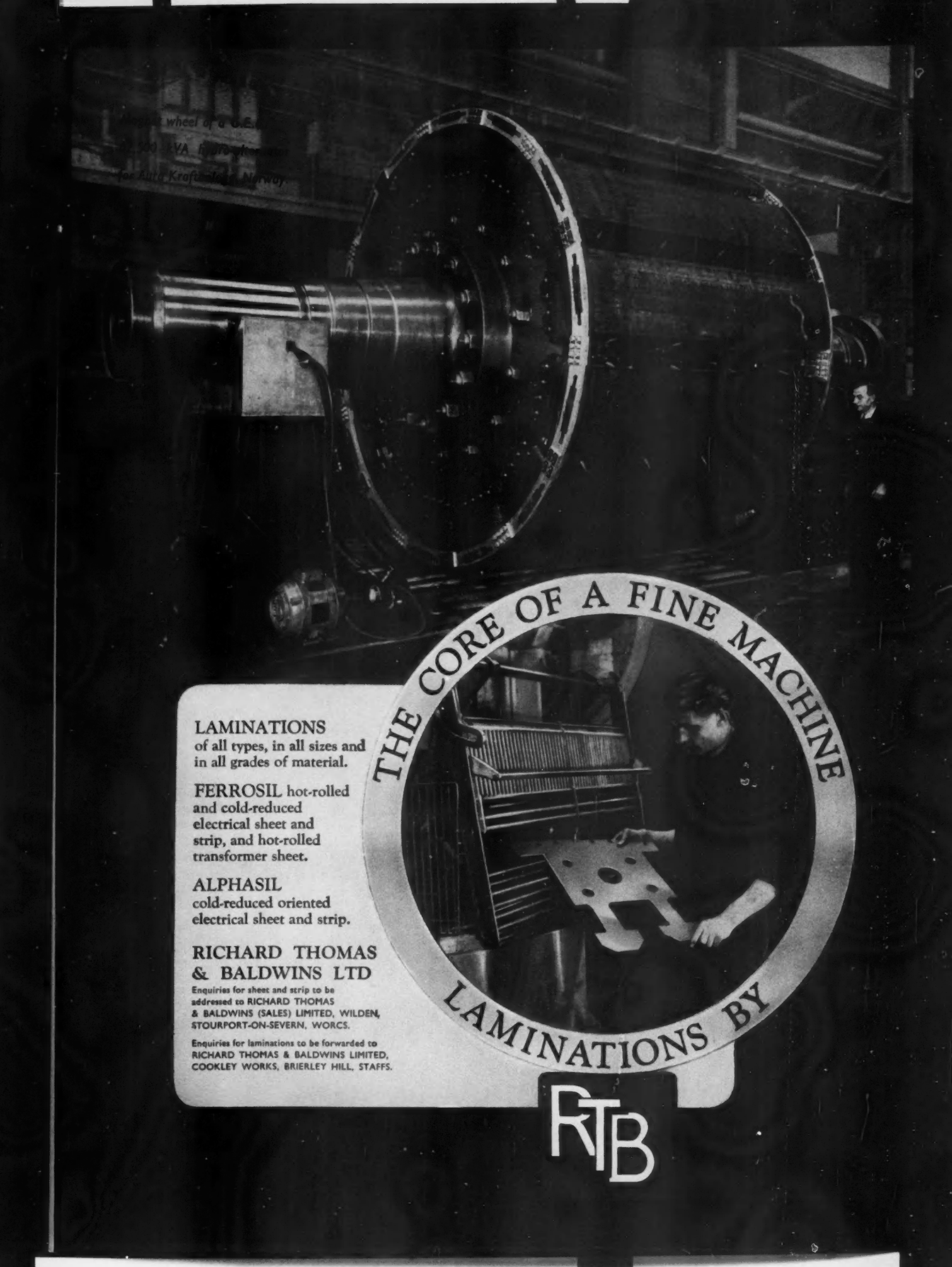

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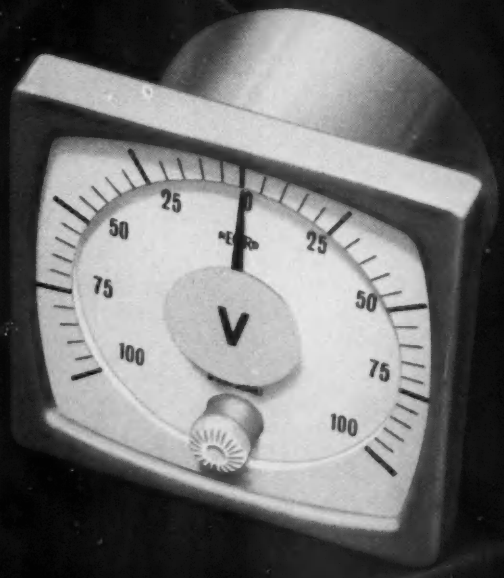

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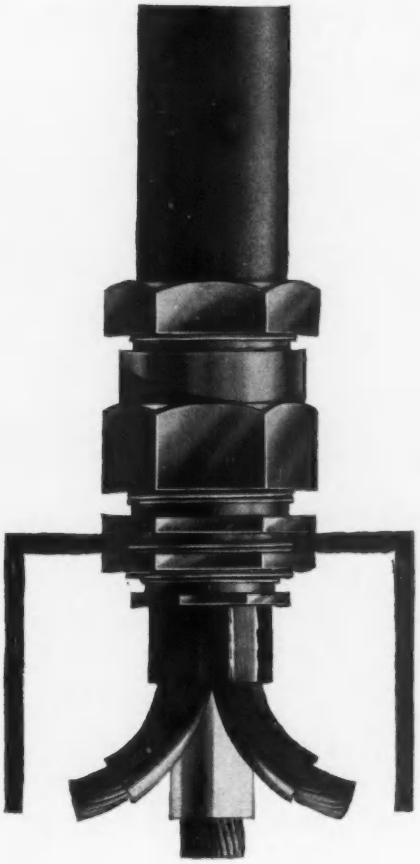

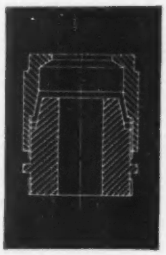

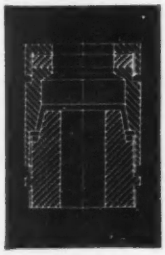

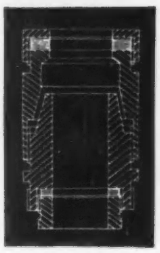

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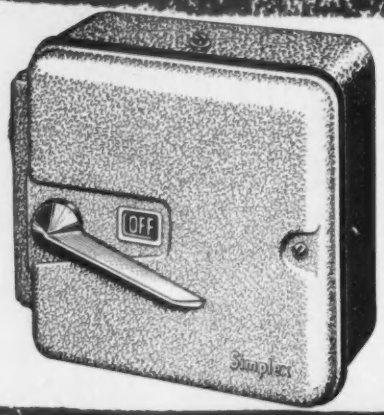
Simplex Star Switchgear



Simplex Star Switchfuse. Strong pressed steel case. Superbly styled.

Star Switchfuse with cover open showing interior hinged forward for ease of wiring.

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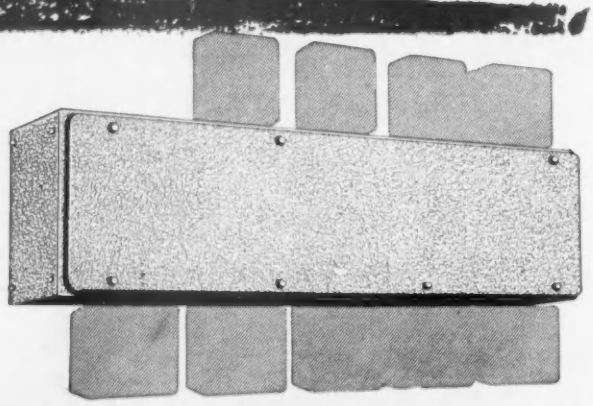
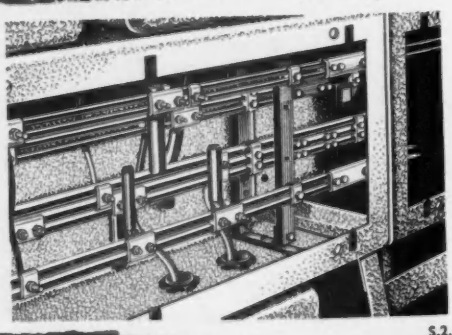
Simplex were one of the first to develop a complete range of front operated switchgear. The advanced design is: remarkably simple to install and maintain · low in price, and completely safe. They are available in 15, 30 or 60 amp ratings, 500 volt A.C. or 250 volt D.C. The Busbar Chambers are available in 600 volt, 200, 400, 600 and 800 amp ratings · are readily extendable · have a high through-fault capacity · universal clamp connections — no drilling — no sweating. More details of Simplex Star Switchfuses and Busbar Chambers on request.



Star Busbar Chamber.



Close up of interior of Star Busbar Chamber showing main branch terminals, and busbar arrangements.

Cables cut away for purpose of illustration

S.2.

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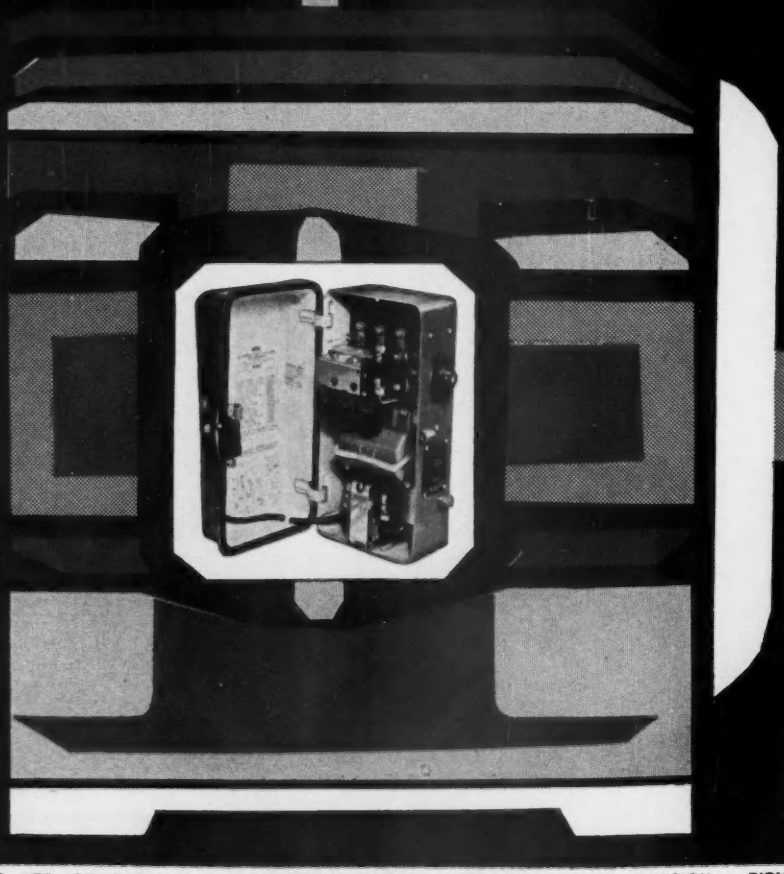
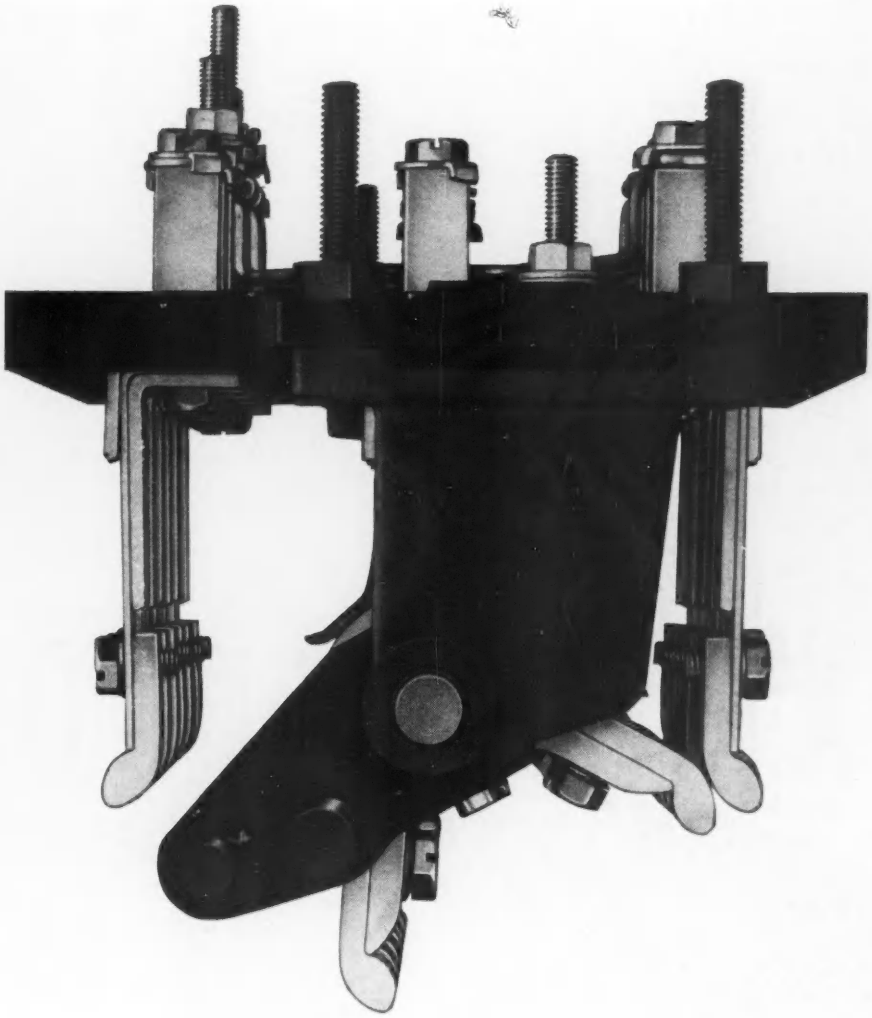


THE GENERAL ELECTRIC CO LTD OF ENGLAND · ENGINEERING GROUP · ROTATING PLANT DIVISION · BIRMINGHAM 6



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Whichever way you look at it, this contact mechanism for an "Ellison" Star-delta Starter represents a minor masterpiece of engineering. It mirrors that striving towards perfection so evident in every component that goes into the making of Ellison Switchgear.

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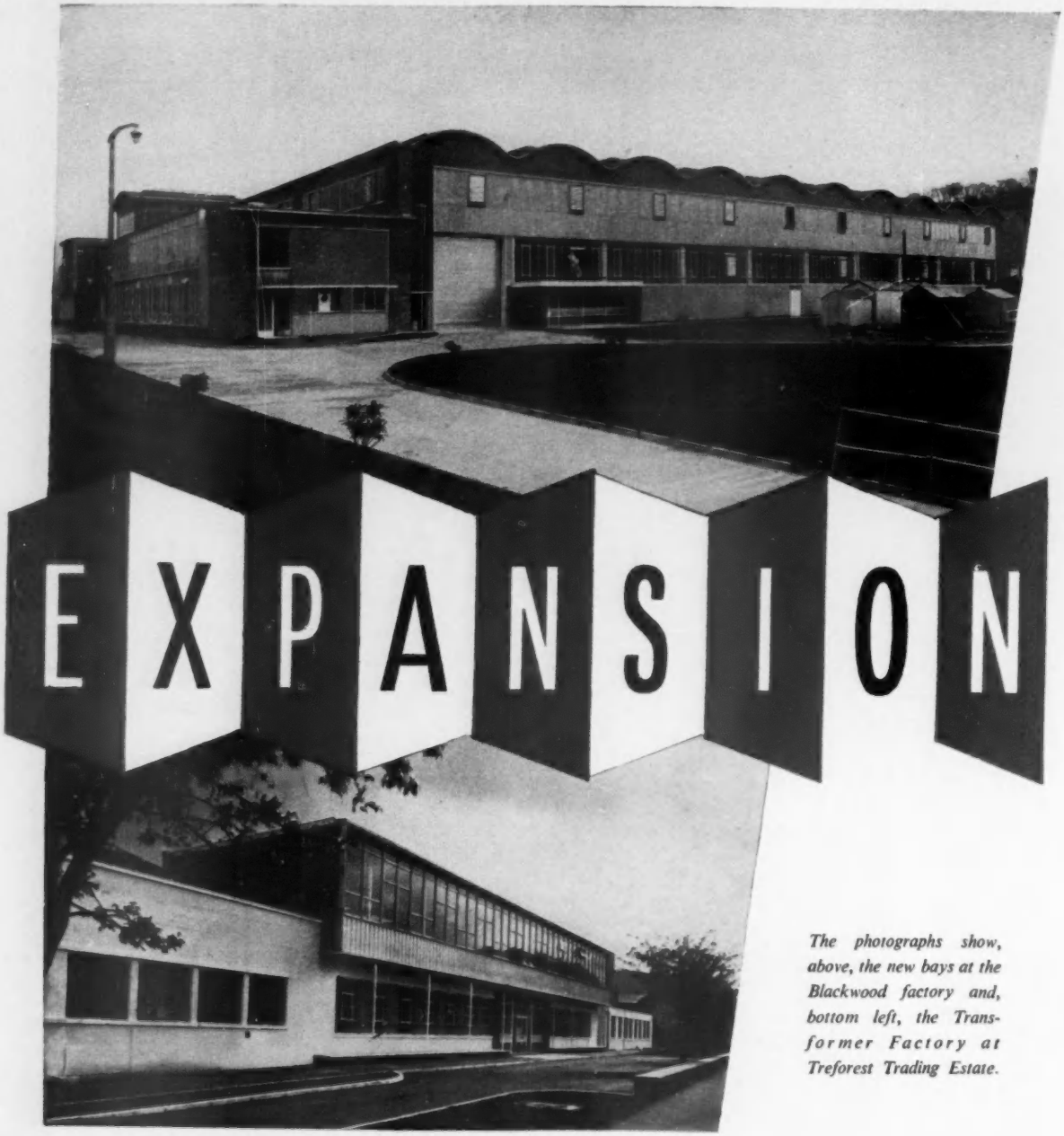

The photographs show, above, the new bays at the Blackwood factory and, bottom left, the Transformer Factory at Treforest Trading Estate.

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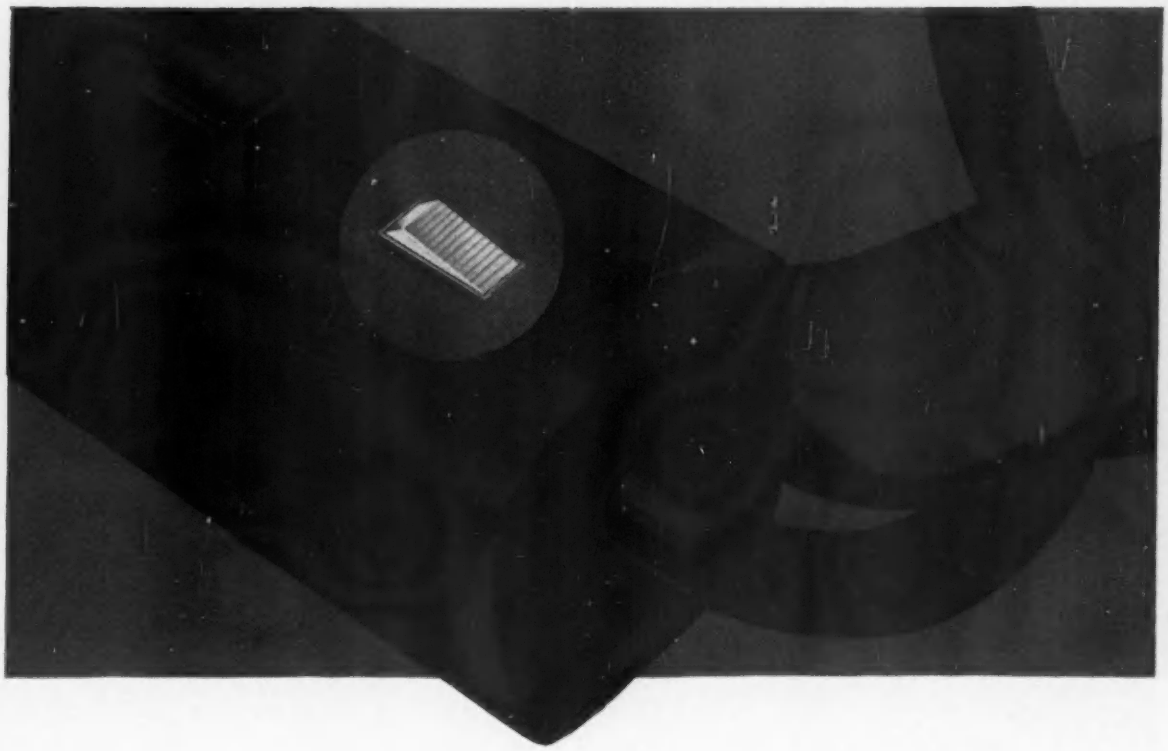

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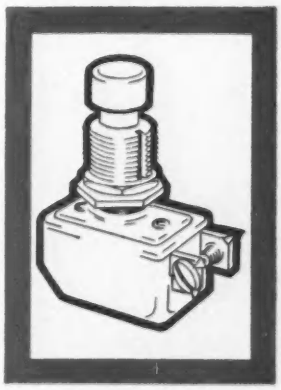

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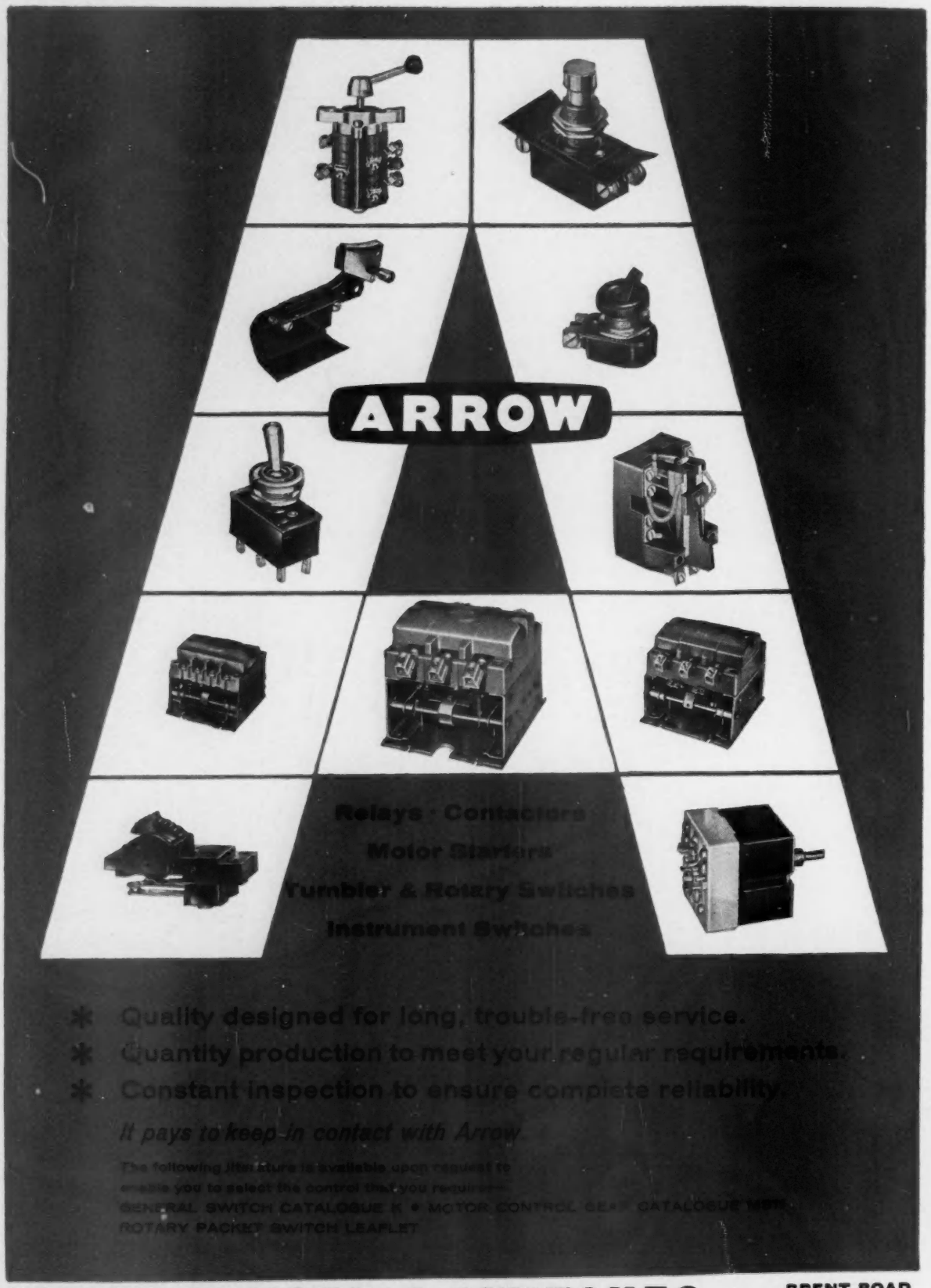
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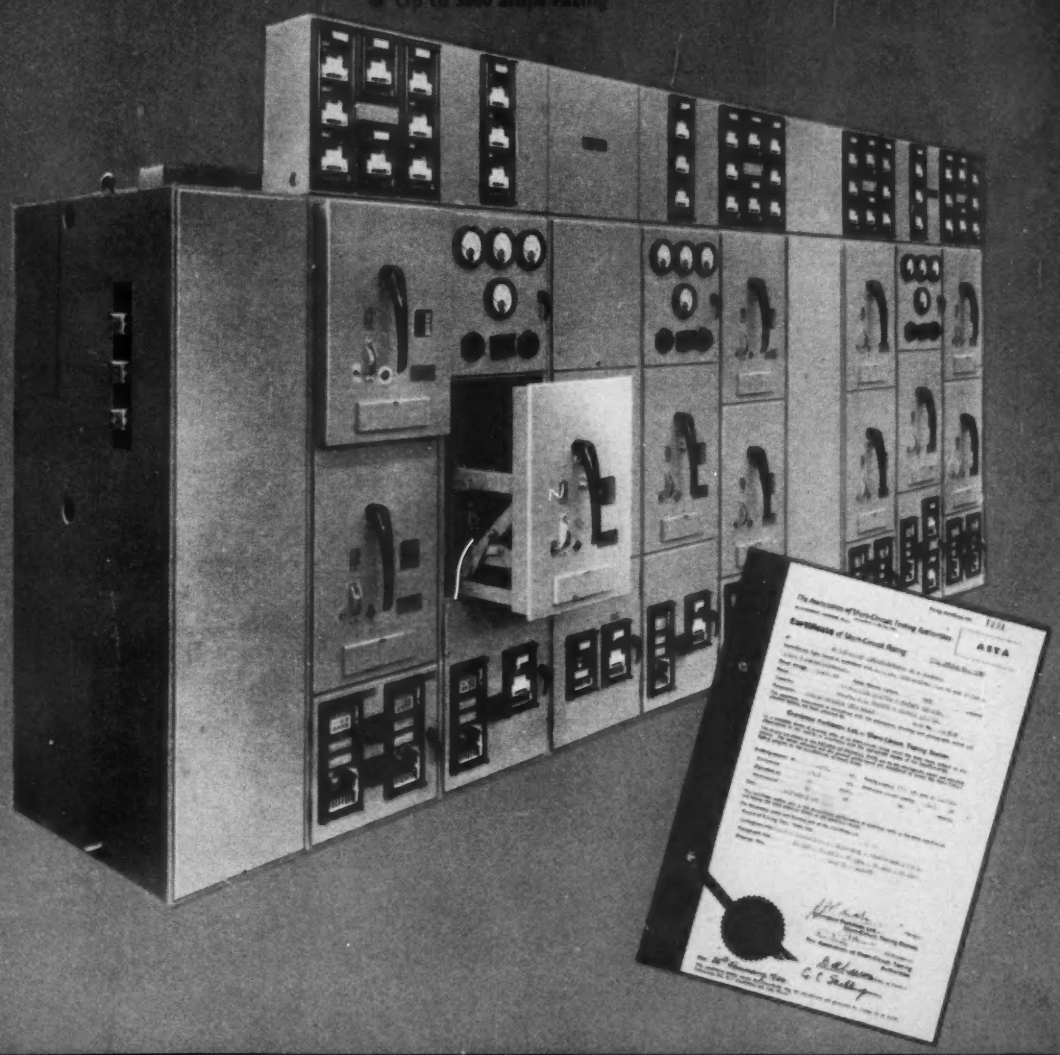

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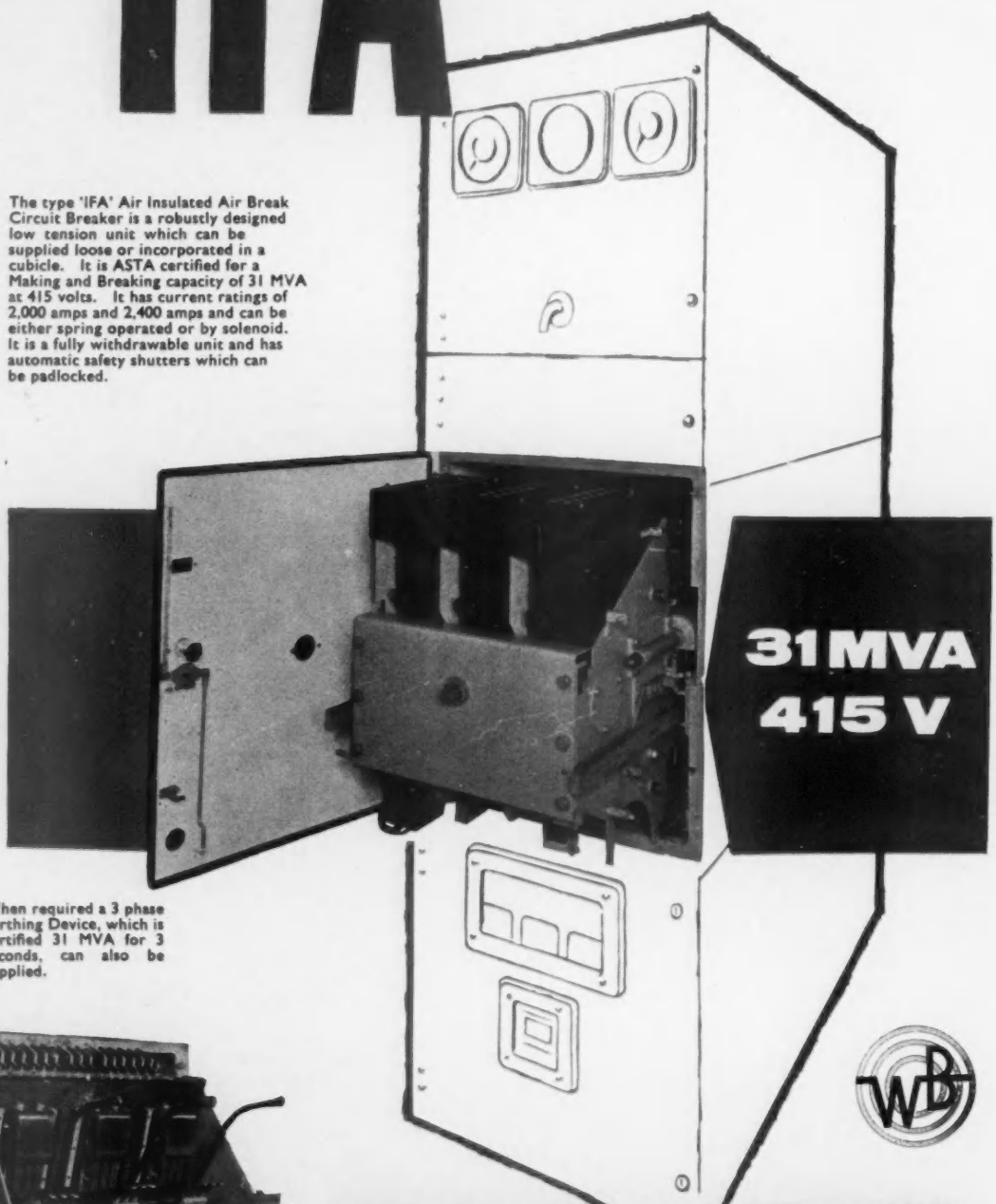
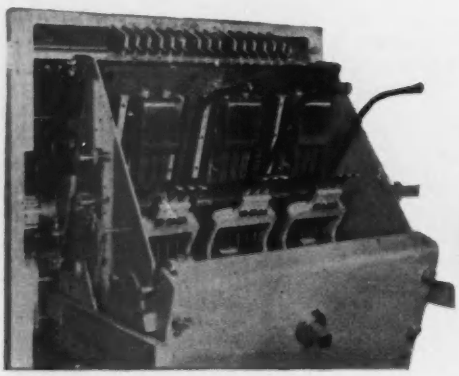


When required a 3 phase Earthing Device, which is certified 31 MVA for 3 seconds, can also be supplied.



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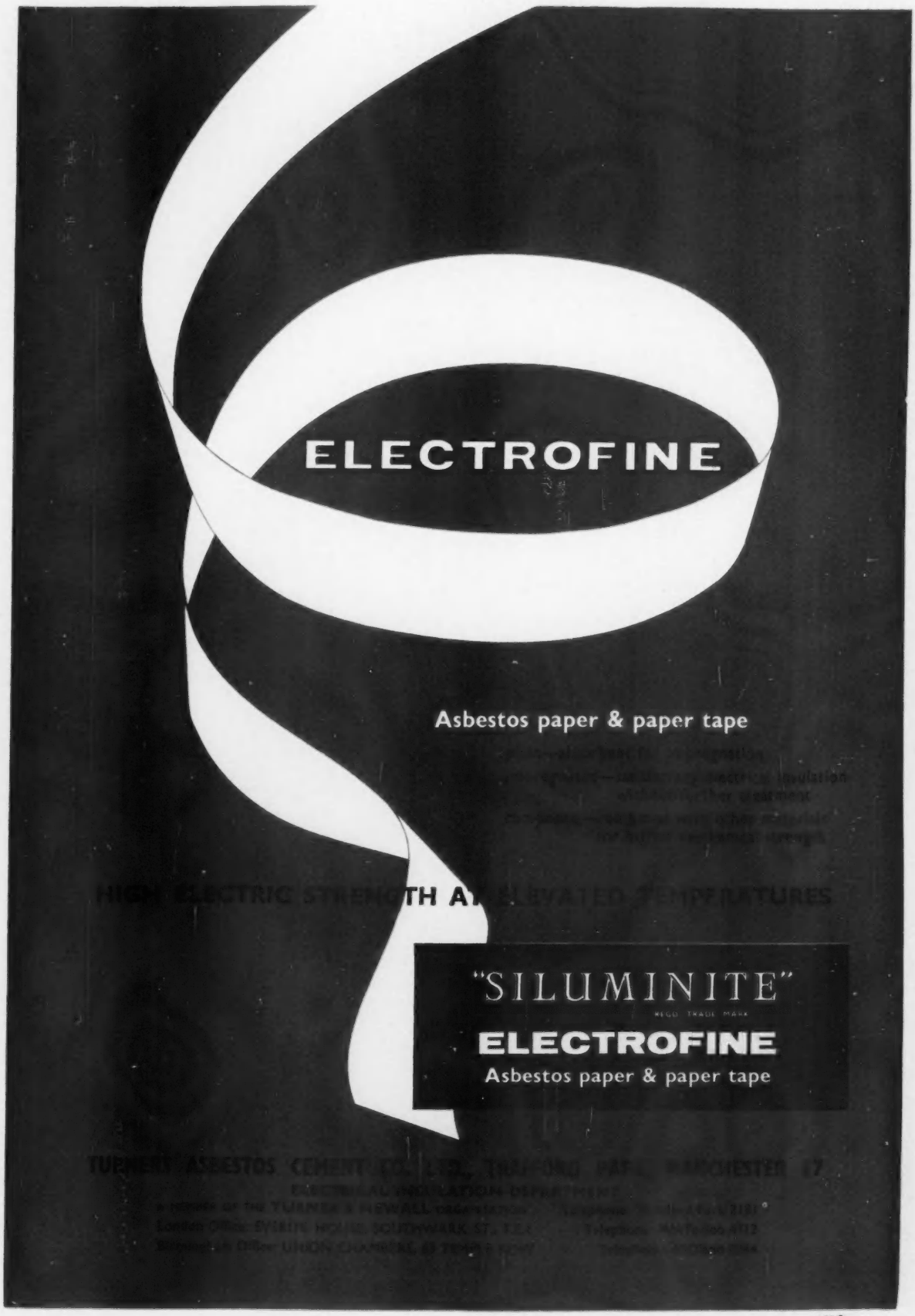
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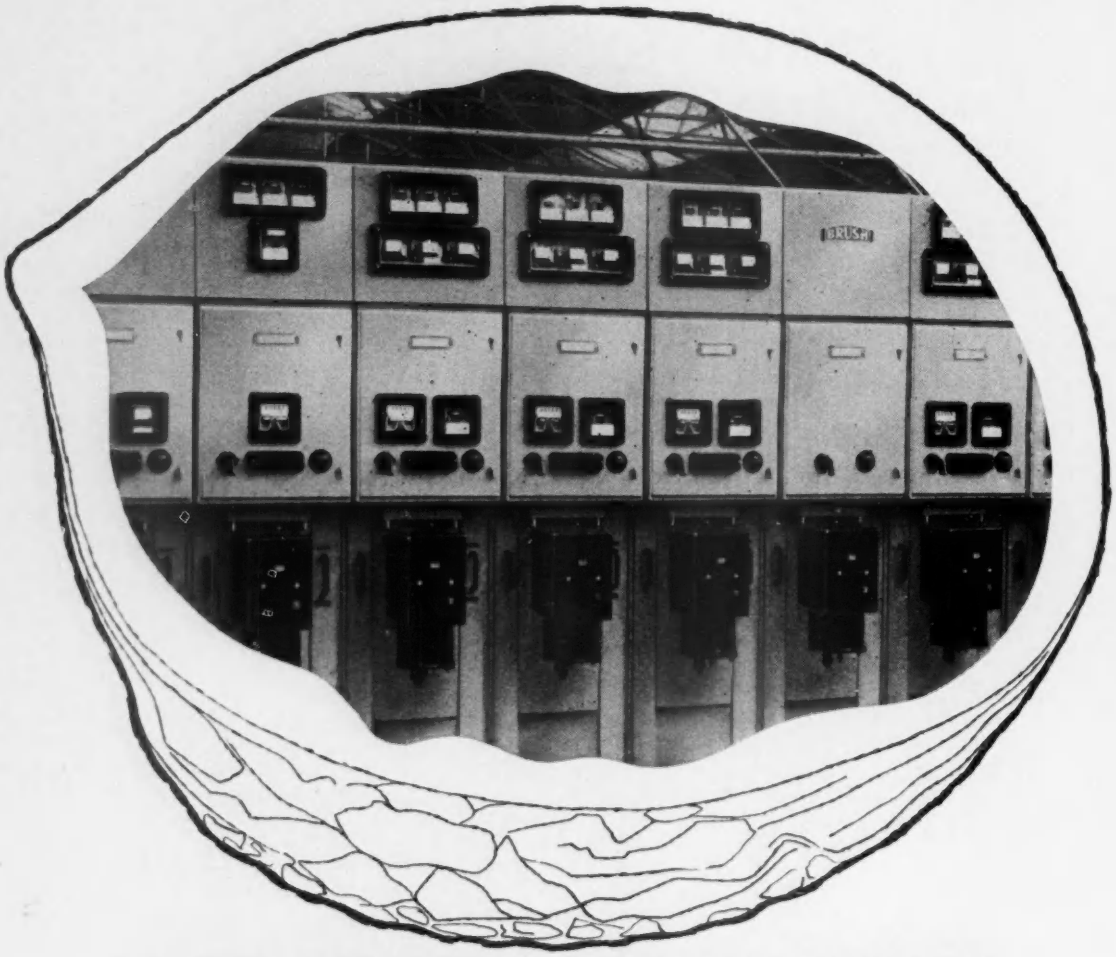

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Brush Switchgear offers: *Versatility. Compactness at high MVA Ratings. Easily accomplished uprating to higher MVA levels.*

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5 amp 1 way D.P.
5 amp 2 way S.P.
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5 amp intermediate
5 amp 1 way secret
5 amp 2 way secret
Bell Push
Neon Indicator
Blanking Unit

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INSTALLATION EQUIPMENT GROUP

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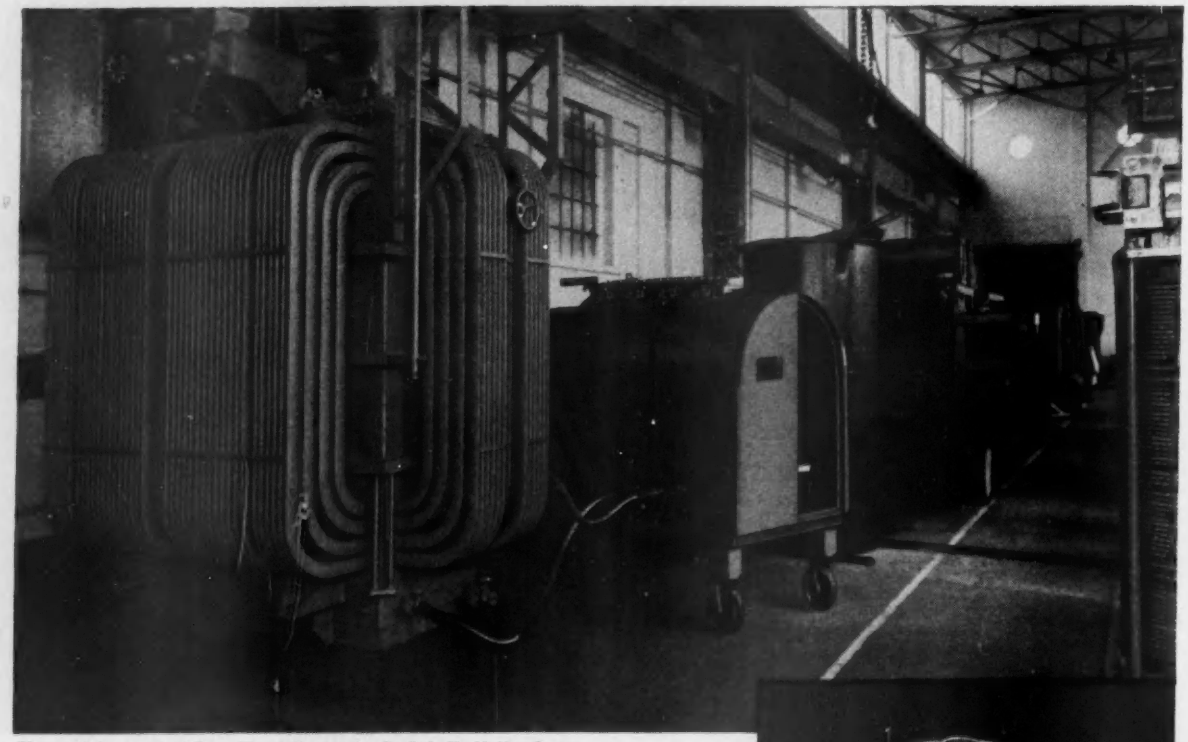

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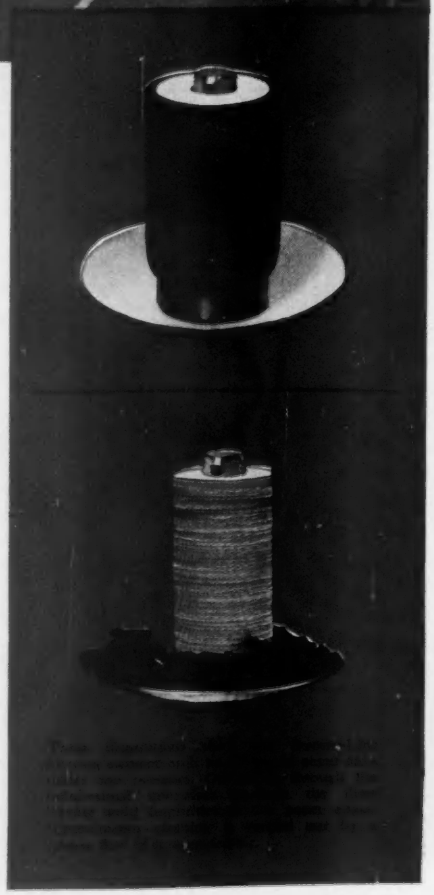

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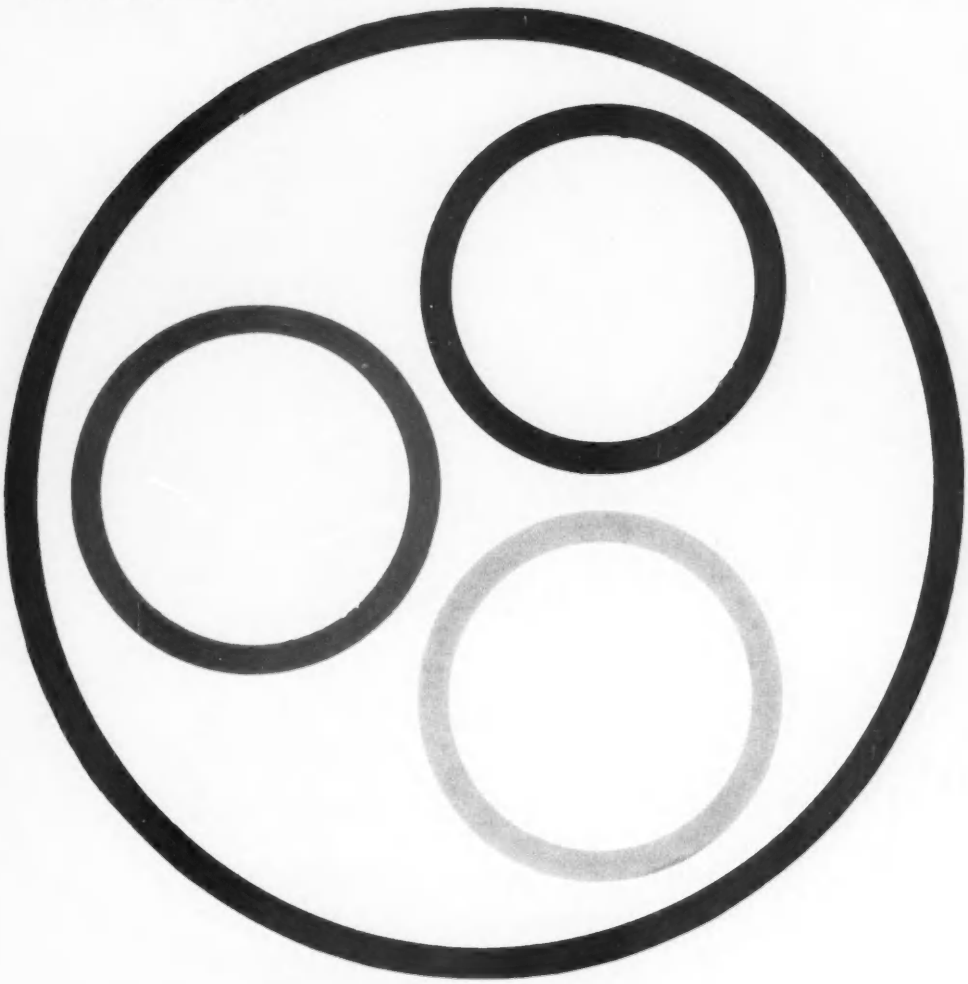

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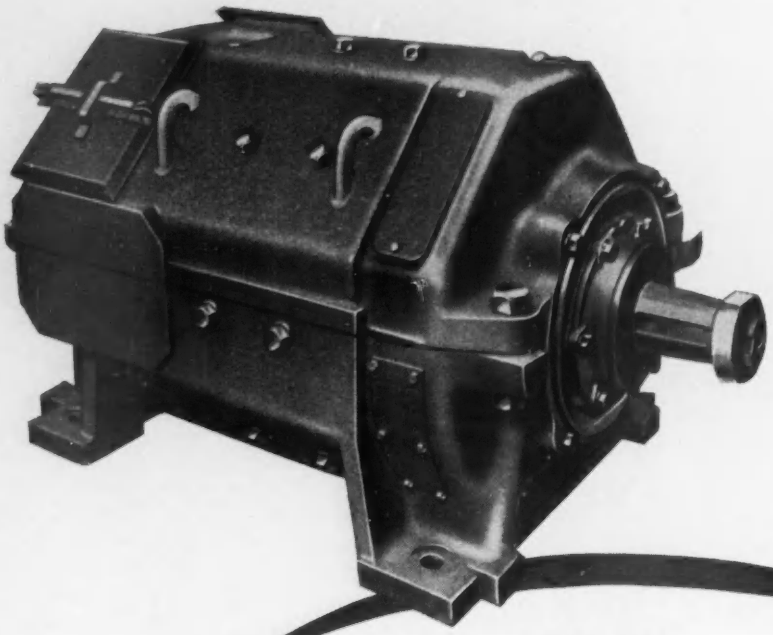

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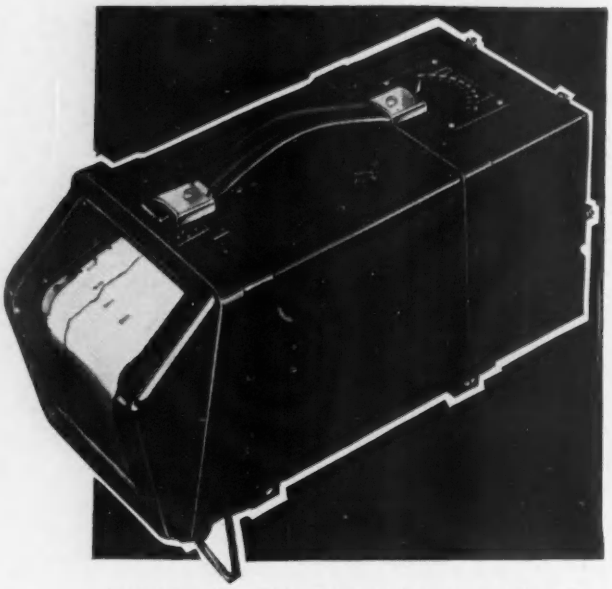
Everett Edgcumbe Recorders keep continuous silent watch



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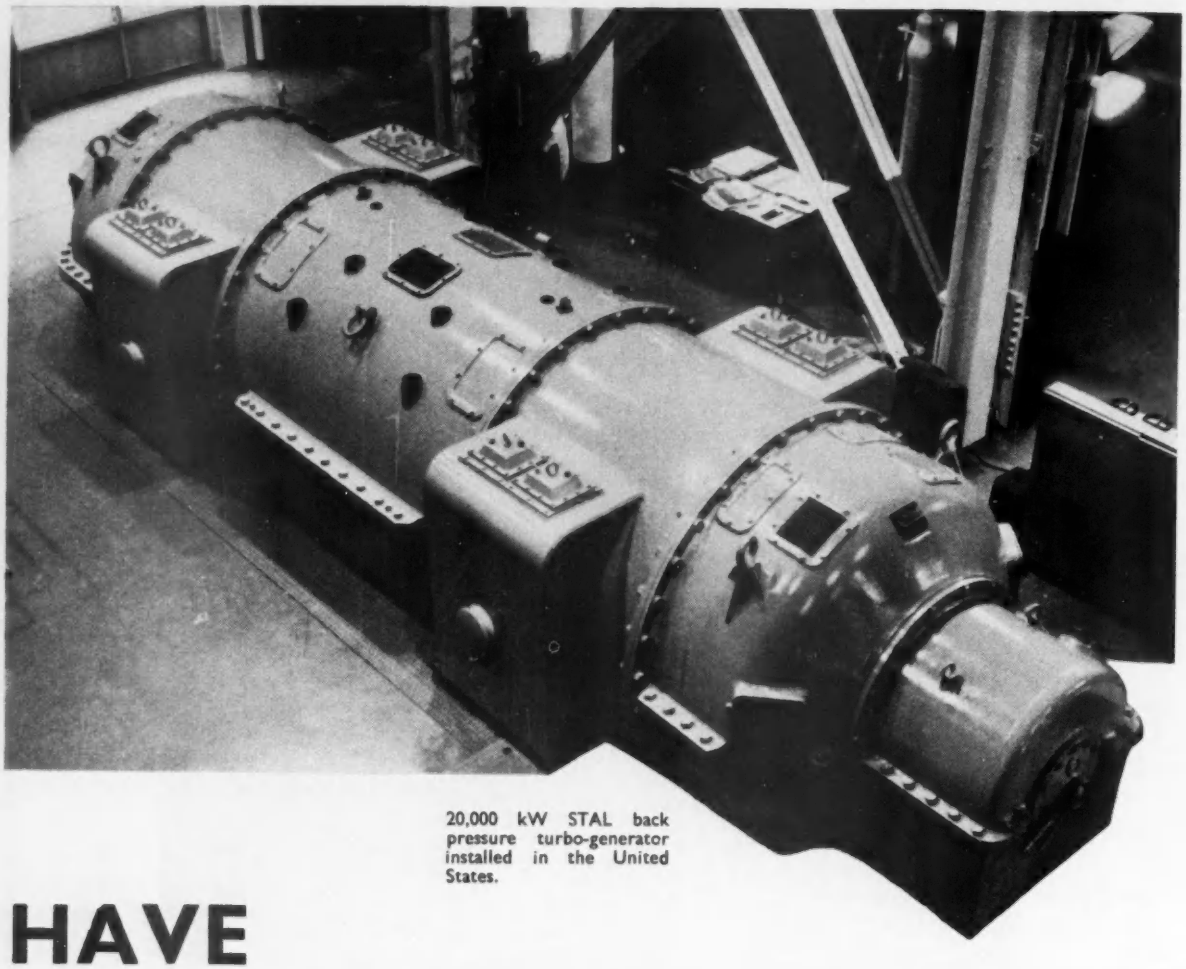

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*T1*and T2** are wires of the nickel-chromium/nickel-aluminium type for use at high temperatures and conform to the British Standard Specification 1827:1952 within the usual tolerances. They also meet the requirements laid down in Air Ministry Specifications 1632 and 1705 covering extensions leads. *Special Advance** wire (60/40 copper-nickel) is for use with copper up to 400°C and with iron up to 900°C. The EMF requirements of these two combinations vary according to individual specifications. Special Advance* wires can be selected in most cases to meet these varying demands within the usual tolerances.

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'HIDUTAC' switchfuses break 8 times their rated full load current

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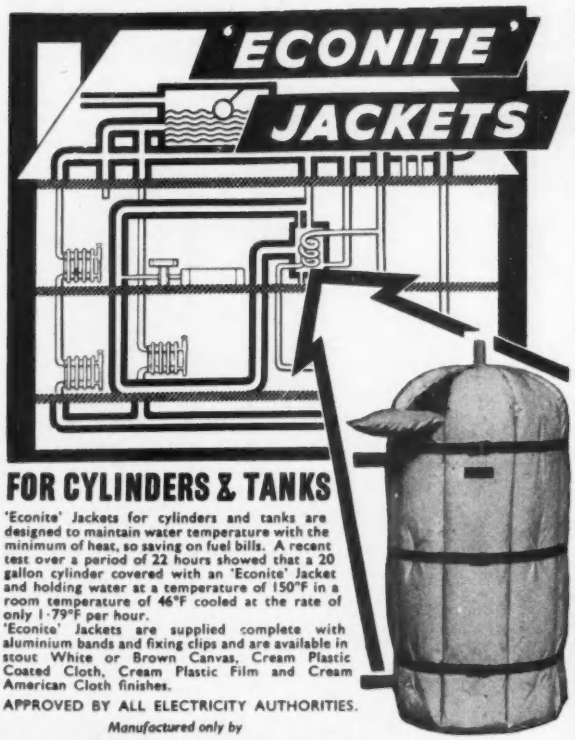

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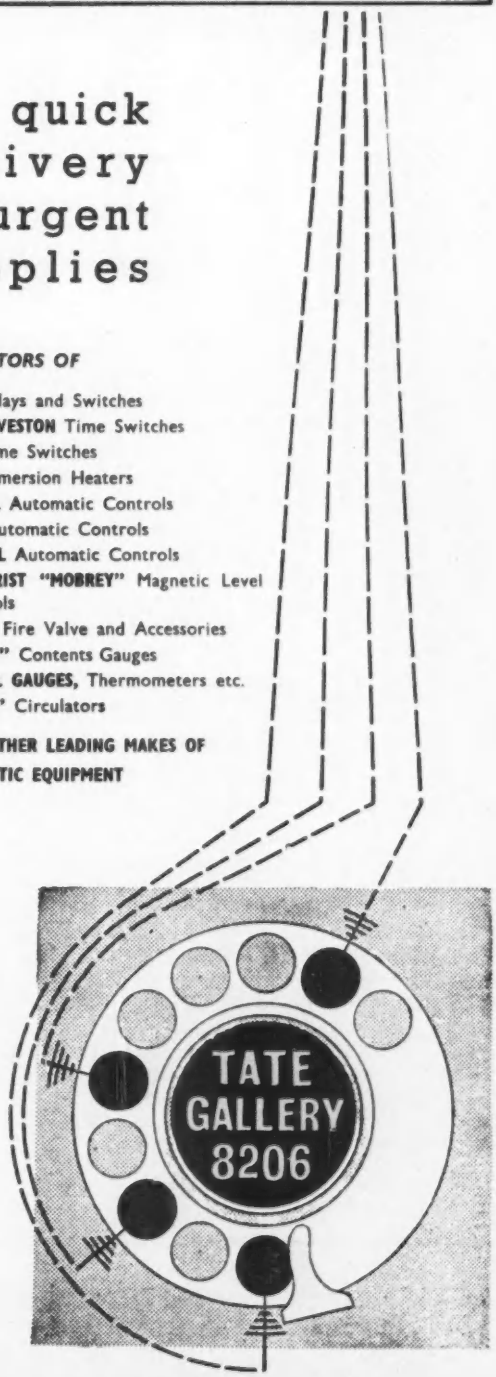

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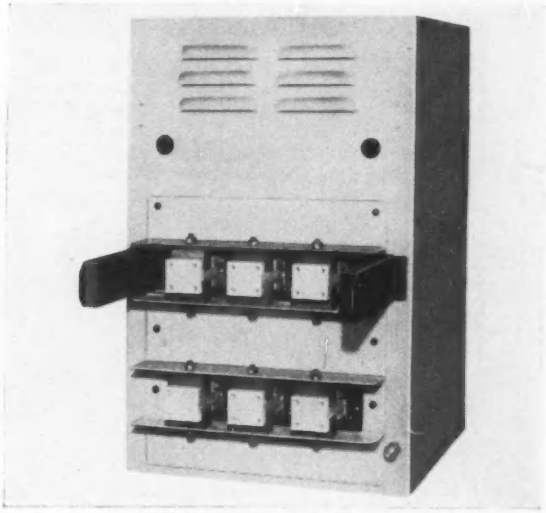
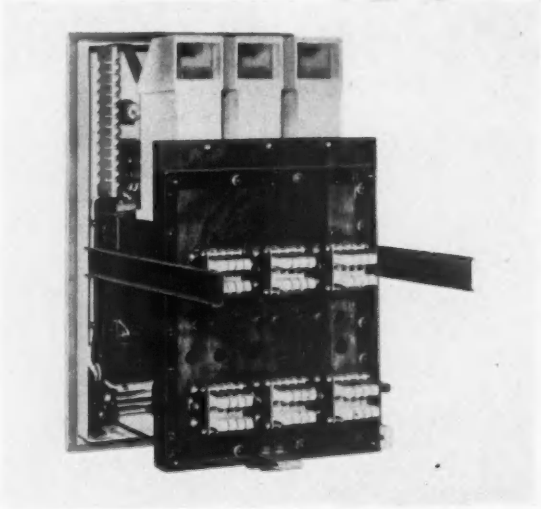
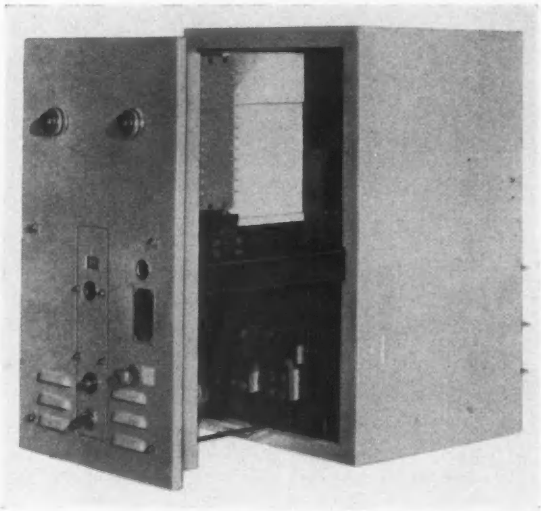
FRONT VIEW OF COMPLETE CUBICLE



REAR VIEW OF CUBICLE



REAR VIEW OF CIRCUIT BREAKER



FRONT VIEW OF CUBICLE WITH BREAKER ISOLATED

BREAKING CAPACITIES — 26 MVA & 31 MVA AT 415 VOLTS TO B.S. 116/1952

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Maximum legibility and good taste are combined in the Gents wall clocks shown here.

Styled by a leading industrial designer they provide a choice of standard models which fit happily into present-day surroundings and décor.

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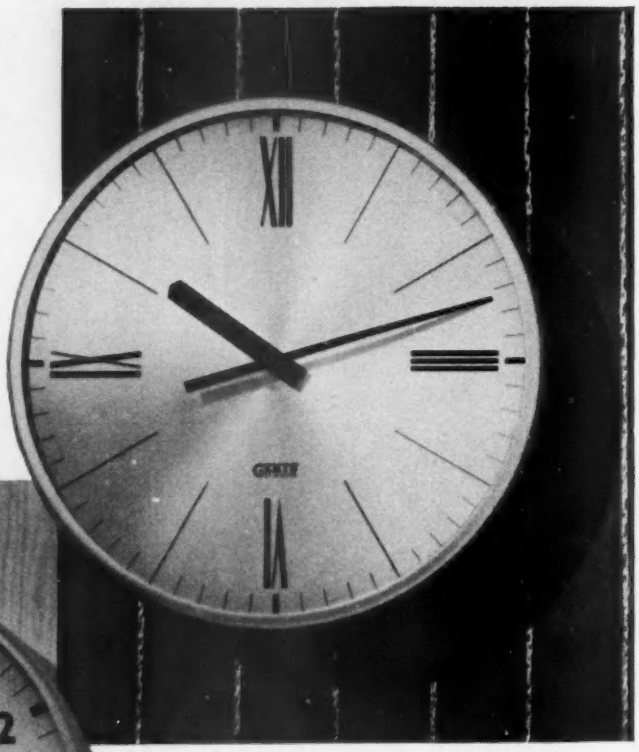
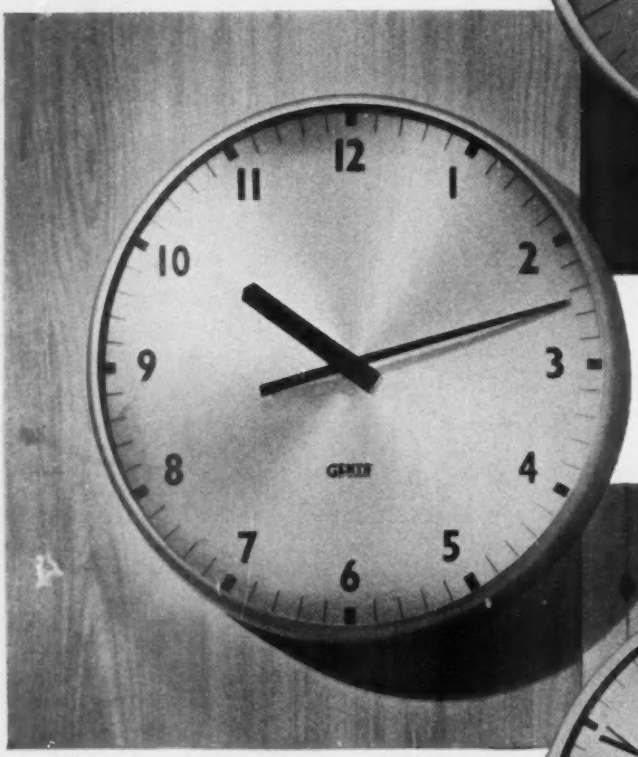
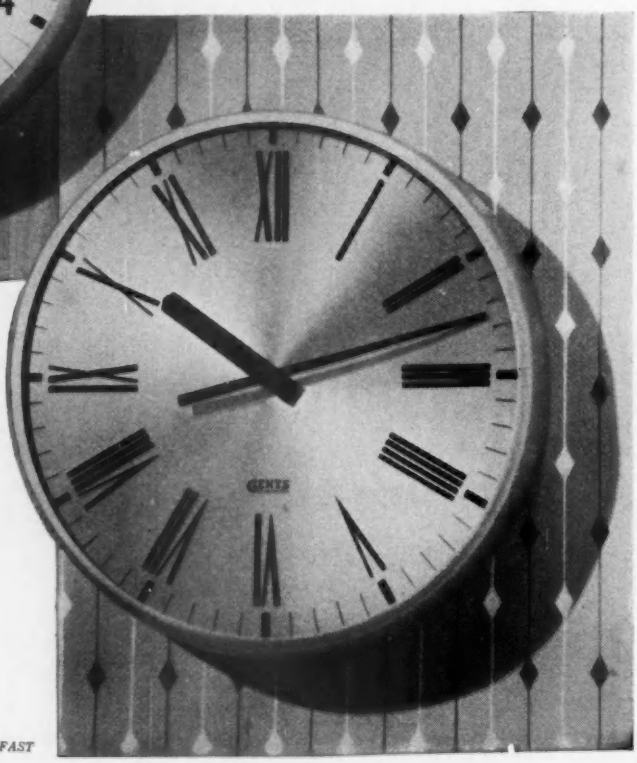
All are available for operating either on A.C. Mains or as part of a Master Clock System.





In every way...Right!



Most models are now available from stock

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THURSDAY 15 JUNE, 1961
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ELECTRICAL TIMES

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Dans ce numéro

Dispositifs de protection sur les réseaux d'alimentation rurale ... 939

Afin d'améliorer la continuité de l'alimentation dans les systèmes de distribution rurale de 11 kV à lignes aériennes en Ecosse, on a fait usage de disjoncteurs à ouverture et refermeture rapides. Une plus grande amélioration a été réalisée grâce au remplacement des fusibles par des raccords solides; en cas de panne continue, les lignes sont débranchées par des disjoncteurs. Autre technique satisfaisante: l'usage d'intervalles à double barre pour la mise à terre des à coups de courant; ces dispositifs sont installés aux bornes des transformateurs reliés aux lignes qui sont contrôlées par des disjoncteurs à refermeture automatique.

Prévisions relatives à l'alimentation en électricité ... 944

Les chefs de l'industrie électrique en Grande-Bretagne tiendront cette semaine leur convention annuelle. Ils ont eu connaissance des prévisions quant au développement de l'alimentation en électricité dans le Royaume-Uni pour les quarante années à venir. Il est prévu qu'en 1985 au plus tard, la demande aura atteint 100.000 MW, et que d'ici l'an 2000 le chiffre aura été porté à 150.000—200.000 MW. Dans un avenir immédiat, l'accroissement du chauffage électrique ménager exercera vraisemblablement une grande influence sur l'accroissement de la charge. Perspective immédiate quant à la transmission d'électricité: la reconstruction du système de 275 kV afin que ce dernier soit porté à 400 kV. D'ici 1975, il sera nécessaire de superposer un réseau de tension supérieure pour la transmission en gros de l'alimentation; l'on propose à cet effet une tension de 700 kV avec une transmission de 6.000 MW de puissance sur une distance de 160 à 220 km. L'on s'est penché en particulier sur le problème qui consiste à limiter le nombre des lignes de transmission aériennes qui déparent l'aspect des campagnes. On ferait usage de câbles souterrains pour les derniers 800 m avant une sous-station desservie par plusieurs lignes aériennes.

In dieser Nummer

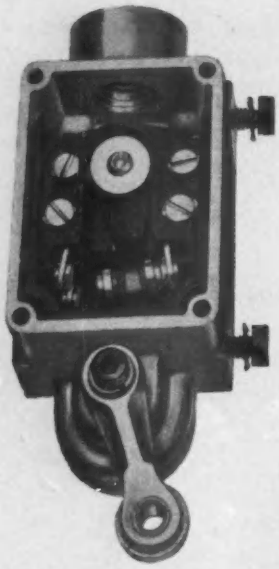
Schutzmassnahmen bei Provinzkraftnetzen ... 939

Zur Verbesserung der Beständigkeit der Stromversorgung bei den schottischen, mit 11 kV arbeitenden Überlandfreileitungssystemen hat man Trennschalter mit Schnellauslösung und -wiedereinschaltung eingesetzt. Eine weitere Verbesserung konnte dadurch erzielt werden, dass Sicherungen durch unterbrechungslose Verbindungen ersetzt wurden, wobei die Abschaltung der Leitungen im Falle hartnäckiger Fehler den Trennschaltern zugemutet wurde. Nach einer anderen erfolgreichen Methode sah man Überspannungsableiter in Form von Zweistangen-Funkenstrecken an den Klemmen solcher Transformatoren vor, die an von Trennschaltern mit automatischer Wiedereinschaltung überwachte Leitungen angeschlossen sind.

Stromversorgung in der Zukunft ... 944

Führende Persönlichkeiten der elektrotechnischen Industrie Englands haben sich diese Woche auf ihrer jährlichen Tagung zusammengefunden. Sie haben Voraussagen über die Entwicklung der Stromversorgung im Vereinigten Königreich innerhalb der nächsten vierzig Jahre anhören können. Man nimmt an, dass spätestens 1985 ein Bedarf von 100 000 MW, und im Jahre 2000 von 150 000 bis 200 000 MW erreicht sein wird. Was die unmittelbare Zukunft betrifft, so dürfte wohl die wachsende Elektrifizierung der Heimbeheizung einen beträchtlichen Einfluss auf den Lastanstieg haben. Der baldige Umbau des 275 kV Systems auf Betrieb mit 40 kV bei der elektrischen Kraftübertragung liegt daher nahe. Bis 1975 wird die Hinzufügung eines mit höherer Spannung arbeitenden Netzes für die Grosskraftübertragung notwendig werden, und man zieht hierfür 700 kV in Betracht bei einer Leistungsübertragung von 6000 MW auf Entfernungen von 160 bis 220 km. Grösstes Augenmerk wird darauf gerichtet, die durch Freileitungen verursachte Landschaftsverunstaltung einzuschränken. Für die letzen 800 m vor Unterwerken, an die mehrere Freileitungen angeschlossen sind, können unterirdische Kabel Verwendung finden.

A STYLE APPLICABLE TO EVERY INDUSTRY



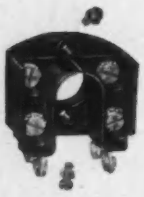
Two only replaceable assemblies in the electrical side: moulded one-piece contact block and arm. Interchangeable on all Mark II versions.

Water Oil and Dustproof or Flameproof versions

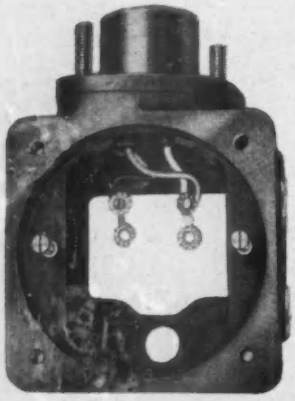
STANDARD

WATER, OIL & DUSTPROOF

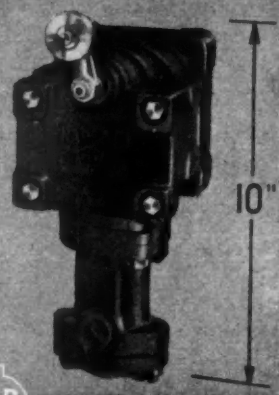
Single pole, double break, double throw, operates with either circuit normally open with other closed, or maintaining in either position, or available with central (neutral) position and/or centre connection. Heavy aluminium die-cast case. Conduit ¾" B.S., or No. 3 Admiralty Pattern Cable gland entry. Two-screw side mounting or backplate mounting in two styles, or Tandem style (back to back mounting). Operating lever position adjustable in 7.5 deg. increments through 82.5 deg. either way from normal.



Standard Neutral position or Centre connection



The mechanism of the Flameproof switch is easily removable as a unit for servicing.



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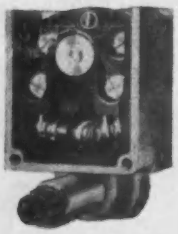
MARK II

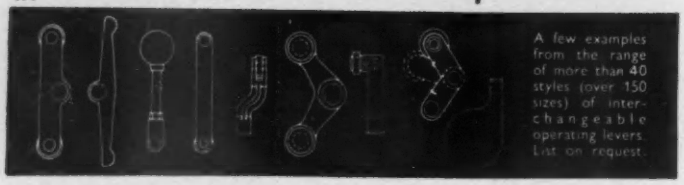


B.S.A. SNAP-LOCK ACME

Catalogue of switches and levers on request

HEAVY DUTY LIMIT SWITCHES

471



A few examples from the range of more than 40 styles (over 150 sizes) of interchangeable operating levers. List on request.

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ELECTRICAL
TIMES

ESTABLISHED 1891

THURSDAY, 15 JUNE, 1961

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T. W. WRIGHT

Comment

FORTY YEARS ON

Prediction is at the heart of electricity supply engineering. Decisions on new power stations and on major transmission schemes have to be taken six or seven years ahead of commissioning date to meet manufacturing and constructional needs, so estimates of future load over these periods is a commonplace. But it is seldom that the industry's leaders look so far ahead as 40 years, as does Sir John Pickles in his presidential address to this year's British Electrical Power Convention. Despite some caution in accepting for so long the ten-year load doubling rule, he concludes that between 150,000 MW and 200,000 MW of generating plant will be required for the UK as a whole by the end of the present millennium, compared with today's total of 32,000 MW. This is beyond the capability of British coal supplies, although whether it will be outside the possibilities of oil is less clear. Certainly, by that time, economic nuclear power should be available, although Sir John seems to discount hopes of fusion energy by then and, indeed, questions the wisdom of continuing the present high research spending in this field. Yet, although nuclear energy is reasonably assumed a major factor from perhaps the mid-1970s onwards, it is notable that neither in Sir John's estimates nor in those Sir Christopher Hinton presents in a Convention paper, are there any signs of a belief that nuclear techniques will have advanced to the stage where load centre generation in nuclear stations will have reduced the need for bulk transmission of electricity, which was one of the earlier nuclear programme hopes. In 1975, at any rate, the importance of the Midlands generating stations, suitable because of cooling water as well as coal, will demand a 700 kV transmission system transferring loads of as much as 6,000 MW over 140-mile routes to London; this superimposed on the present 275 kV system, by then uprated to 400 kV. The decision is firm enough to occasion research work now to make 700 kV practicable in Britain's polluted climate. The probability of such heavy use of electricity emphasises the need for a high quality of service. In Sir John's words: "With the increasing dependence of the consumer on electricity, continuity of supplies will have become even more vital." That is an attitude which is sure of wholehearted support from the supply industry.

HOME HEATING OPPORTUNITY

Closer at hand than the programmes for the year 2000 is the opportunity of picking up a large increase in domestic demand from home heating. The industry has been energetically pursuing this load from the aspect of off-peak demand for

some time. Now comes an added opportunity in the gathering momentum of the Clean Air Act provisions, by which local authorities can subsidise householders' change to electric heating. Sir John Pickles sounded a warning in his BEPC address, that it is doubtful whether the supply industry has fully realised as yet the potential electrical load available from this source. He estimates that six million houses are destined in the next 10 or 15 years to be compelled to adopt smokeless fuels. Half of them, he says, will choose electricity. The high proportion of the houses that will opt for electricity is no wild guess; it is based on experience of the early smoke-control areas. If all that load comes on peak it means 3,000 MW in terms of after-diversity demand. It is up to the industry to ensure that much of the demand is off peak. A major step in this direction will be development of controllable block storage heaters, and a more benevolent eye for them on the part of the Treasury; but so far as new homes are concerned, floor-warming provides the major opportunity. At present, a tide of official opinion in its favour is setting in. The latest sign of this is a report from the Building Research centre, which endorses claims for low capital cost and also low running cost. More important, it brings evidence of a high level of consumer satisfaction. That is a particularly persuasive result.

TWO-PART ADEQUATE WIRING

All pleas for adequate wiring of domestic premises receive nodding approval within the industry but, unfortunately, lead to no action. The ring-circuit, the one new concept the industry has produced towards providing better electrical facilities in the home at reasonable cost, has been allowed to drift directionless across the path of local councils and speculative builders. Recent statistics show throughout the country an average of little more than one socket-outlet per room, hardly better than it was ten years ago. Mr P. Honey, of EDA, stresses this point in an article this week, suggesting some improvements in the ring-circuit. But his plea is likely to fall on as deaf ears as before. There still remains too much of the £*x* a point concept, regardless of the number required, and this attitude extends through even to middle management levels of area boards. The economies of the ring-circuit would be better appreciated if the two-part nature of the costs was reflected in estimates; if a basic charge was made for the ring wiring itself plus a low price per socket-outlet required. While the cost of the ring would be determined by the nature of the installation, the cost of connecting outlets to the ring should vary little between different types of installation. Such a step would encourage larger installations and might even have some influence on the speculative builder with his extras. Useful as this concept may be, the real answer to adequate domestic installation lies in the hands of the supply industry. We have often drawn attention to the success of the "medallion house" schemes in North America; something like this is badly needed in this country. Yet no attempt is made even at the initial step.

EUROPEAN LINK

The cross-Channel cable now undergoing tests will link the UK not only with France but also with the Europe-wide supply network. International connection is something new for the UK, but far otherwise for France, which has transfrontier lines connecting with all her neighbours, shown in the map we publish this week. The exchange is growing, and with some countries, notably Switzerland, it reaches major proportions. In 1959, the last year for which full figures are conveniently available, the total electrical energy exchange between these two countries was some 800 million kWh each way. In other cases, short-time power interchange is of more significance than sales of energy. For all the member countries of UCPTE, the eight-member authority which co-ordinates such exchanges, the aggregate of loads transferred attained 3,685 MW. The 160 MW link between the UK and France is small beer beside this.

H.P. OR CREDIT

The personal loan system instituted by banks for the purchase of goods has stimulated finance houses to consider some similar arrangement as an alternative to the normal form of hire-purchase. The two methods of credit are entirely different in character, and the legally enforceable lien on goods is replaced by no more than an assessment of the credit worthiness of the borrower. This requires careful investigation of status and financial commitments, a time-consuming process for those having no access to a banking record, one which may be justified in the purchase of a car but necessarily less profitable for smaller loans required to buy electrical appliances. To the borrower, the method has important advantages, since interest on the loan would be allowable against income-tax and there would be no dealers' commission to pay, though a special charge would probably be required by the lending house. There is much to be said in favour of replacing the complicated hire-purchase system with a direct borrower-lender agreement, but the difficulties of administrating such a scheme on anything like the present scale of h.p. agreements are formidable. Not least are the legal problems, which embrace the limitations of the Moneylenders' Act. Nor is it likely that this system will be allowed to become a method of circumventing the present initial deposit requirements. The Government departments at present studying the scheme are unlikely to endorse a backdoor to their own regulations.

Meteor

This week's quick summary of electrical news faces advertisement page 20

High-speed tripping and reclosing on rural networks

by S. H. Money, M.I.E.E.*

Part 1

IN an article in the ELECTRICAL TIMES of 18 June, 1959, an account was given of operating experience on a large 11 kV overhead rural distribution system in the south west of Scotland. Details were given of the number and types of faults sustained, and the improvement in performance obtained by fitting high-speed tripping and reclosing features to the ground-mounted circuit-breakers and by using pole-mounted reclosers. The high-speed clearance of faults and rapid supply restoration make possible other system improvements, and recommendations were made regarding the possibility of:

(1) Discarding 11 kV fuses owing to their fallibility during lightning storms and their inability to discriminate and co-ordinate with other protective devices on the system.

(2) Fitting surge release points in the form of double rod gaps with reduced settings to protect items of plant frequently damaged by lightning surges.

The circuit-breakers used were fitted at the source of the 11 kV lines, i.e., the 33/11 kV primary substations, and were equipped with high-speed and inverse definite minimum time o.c. and e.l. relays with ranges of 50% to 200% on o.c. and 20% to 80% on e.l. One-shot spring-reclosing mechanisms were fitted, and fault clearance was achieved in about six cycles, with reclosure in 25 cycles from the initiation of the fault. The second tripping operation was initiated from an i.d.m.t. relay, which was set to discriminate with other forms of protection further out on the system. The pole-mounted reclosers were of the normally-closed type with individual phase operation, having an operating cycle of two high-speed and two delayed shots. The breakers were of 30 A current rating, tripping occurring on o.c. or e.l. currents in excess of 60 A. Fig. 2 shows the operation timing of the ground-mounted breakers.

The protective arrangements of the ground-mounted breakers and the typical relay settings and operating times for both the pole-mounted reclosers and the ground-mounted breakers used during the period 1959-60 were shown in Figs 2(a), 2(b) and 3 of the original article in June, 1959. With the removal of 11 kV fuses, the delayed trips on the reclosers are no longer necessary and the latter are now being modified to give four high-speed trips, thus keeping the fault arcing time to a minimum.

Recent Developments

At the end of 1960 the mains system, shown in Fig. 1, totalled 2,060 miles of 11 kV overhead mains with 3,977 pole-mounted transformers connected. In spite of a very hot summer in 1959, lightning damage was not unduly

* Mr Money is with the South of Scotland EB.

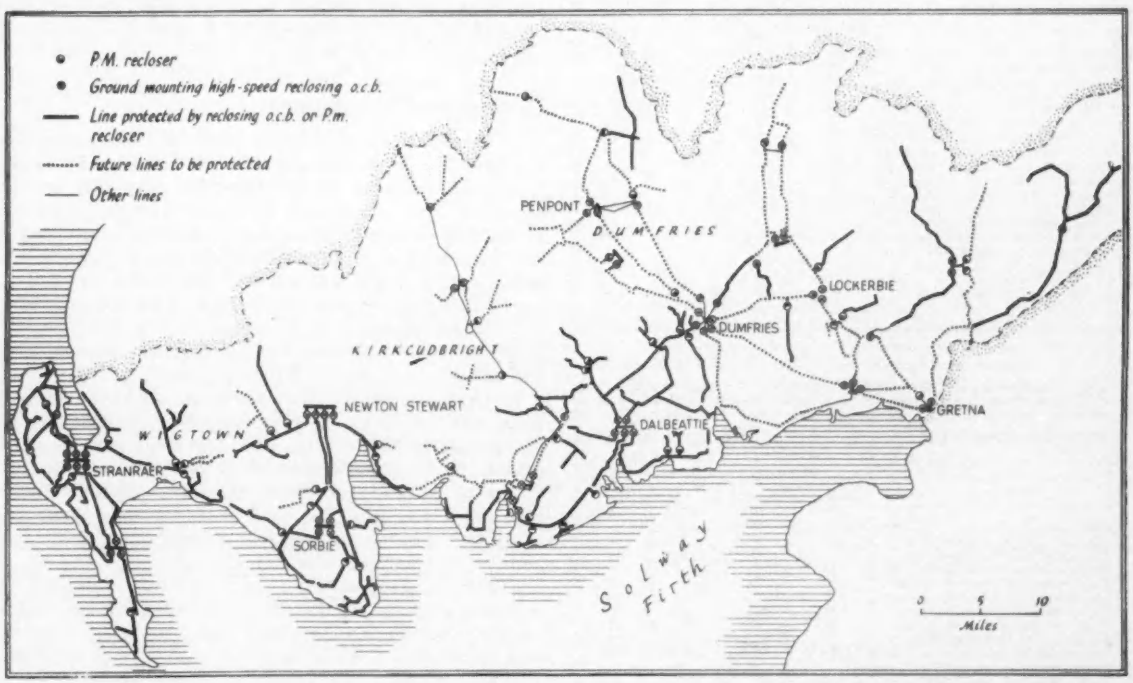


Fig. 1. Dumfries and Galloway area of the South of Scotland EB 11 kV network. Reclosing o.c.b's and pole-mounted reclosers are shown

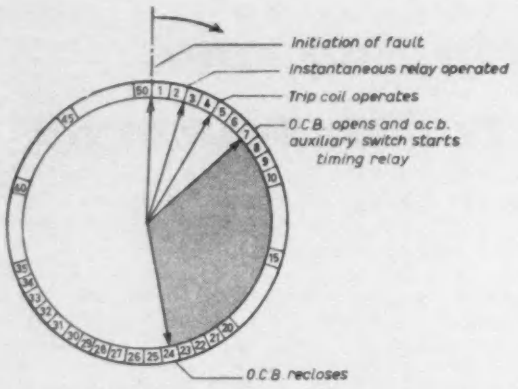

Initiation of fault
Instantaneous relay operated
Trip coil operates
O.C.B. opens and a.c.b. auxiliary switch starts timing relay
O.C.B. recloses

Fig. 2. Operational timing in cycles used on 11 kV ground-mounted circuit-breakers in the South of Scotland EB

Table 1. Performance of Ground-mounted Oil Circuit-breakers with 2 sec I.D.M.T. Relays on System with Fused Spur Lines

	1959	1960
Mileage of main line protected	549	527
Mileage of fused spurs connected	485	535
Total mileage of mains protected	1,034	1,062
Number of persistent faults on main line	39	31
Number of persistent faults on spur lines	24	19
Number of persistent faults on system	63	50
Number of transient faults on main line	53	18
Number of transient faults on spur lines	249	487
Number of transient faults on system	302	505
Percentage of persistent faults	17·3	9·05
Interruptions to supply over 1 sec per 100m/year		
(a) Main line	16·8	9·3
(b) Fused spurs	56·1	91·0
(c) System	35·3	82·2

Table 2. Performance of Ground-mounted High-speed Auto-reclosing Oil Circuit-breakers and Pole-mounted Reclosers on System with Fused Spurs

	G.M. H.S. Automatic Reclosing O.C.B's		P.M. Automatic Circuit Reclosers	
	1959	1960	1959	1960
No. of reclosing units installed ...	25	26	18	20
Mileage of main line protected ...	191	200	161	177
Mileage of fused spurs connected ...	498	523	150	163
Total mileage of mains protected ...	689	723	311	340
No. of persistent faults on main line	13	19	2	2
No. of persistent faults on spur lines	15	5	8	5
No. of persistent faults on system	28	24	10	7
No. of transient faults on main line	145	188	138	38
No. of transient faults on spur lines	105	337	45	34
No. of transient faults on system ...	250	525	183	72
Total number of recloser operations	158	207	222	70
Percentage of persistent faults ...	8·23	9·2	1·4	5·0
Percentage of successful reclosures	91·7	90·8	98·6	95·0
Interrruptions to supply over 1 sec per 100m/year				
(a) Main line	6·8	9·5	1·24	1·12
(b) Fused spurs	24·1	65·0	30·0	20·2
(c) System	19·3	50·0	17·7	12·0

Table 3. Performance of System controlled by Oil Circuit-breakers with High-speed Tripping and Reclosing and Pole-mounted Reclosers with all Fuses removed

	G.M. H.S. Automatic Reclosing O.C.B's		P.M. Automatic Circuit Reclosers	
	1959	1960	1959	1960
No. of reclosing units installed ...	2	7	4	8
Mileage of main line protected ...	17	92	23	55
Mileage of solidly connected spurs	22	153	—	—
Total mileage of mains protected ...	39	245	23	55
No. of persistent faults on system...	2	17	1	3
No. of transient faults on system ...	36	123	30	44
Total No. of recloser operations ...	38	140	55	73
Percentage of persistent faults ...	5·3	12·15	3·2	6·3
Percentage of successful reclosures	94·7	87·85	96·8	93·7
Interruptions to supply over 1 sec per 100m/year on system* ...	5·15	6·9	4·35	5·5

* Outages of less than 1 sec duration not included.

severe; 548 faults occurred, 403 of which were due to lightning; 17·5% of the total were persistent, 82·5% transient. Lightning accounted for 45% of the persistent and 71% of the transient faults. During 1960, lightning storms were frequent and severe, accounting for 778 faults out of the total of 977; 10·3% of the faults were persistent and 89·7% transient. Lightning accounted for 69·2% of the persistent and 80·9% of the transient faults.

Results obtained during 1957 and 1958 with a small number of high-speed tripping and reclosing equipments showed a substantial reduction in the number of persistent faults on the system and a reduction in the number of consumer hours lost through transient faults. This method of control was therefore applied to a much larger section of the network during 1959 and 1960, and two experiments were carried out to ascertain methods of achieving a greater degree of continuity in supply.

The first of these involved replacing, on one section of the network, the 11 kV fuses by solid links and relying on the auto-reclosing oil circuit-breakers to disconnect the supply in cases of persistent fault. Previous experience had shown that a very large percentage of supply interruptions caused by fuse operation were not caused by persistent faults and therefore could be handled by auto-reclose breakers. This had the advantage of avoiding the costly visits to replace h.v. fuses and the long delay in restoring supplies due to the control engineer not knowing of the failure until notified by consumers. The success of this system in reducing unnecessary interruptions led to an extension of this practice on a larger section of the network in 1960.

The second experiment was tried because lightning had caused more damage to plant in this area than any other element. In an effort to minimise its effects, transformers on the lines controlled by reclosers were fitted with rod gaps with reduced settings of 2 in. by 1 in. The use of these has been successful in reducing breakdowns, and the high-speed-tripping breakers have prevented damage to transformer bushings and other equipment due to the fast extinction of the power arc. The supply interruptions limited to half a second have not inconvenienced consumers.

Operational Experience

In Dumfries and Galloway, three different methods of overhead line protection are used on various sections, and to enable engineers to compare the operational results these are shown separately in Tables 1, 2 and 3 for the years 1959 and 1960. Nowadays, when many consumers rely exclusively on electricity for lighting, heating and power supplies, there are several yardsticks that can be applied to judge system performance. In this article, as it is the performance of the system that is being studied, faults/100 miles/year have been used as the measure, as in the surveys made by the ERA.

In Great Britain the fault incidence varies considerably from one district to another, largely depending on the isokeraunic level, the large bird population and gale frequency. In lightning-free districts, the fault level is often as low as 10 faults/100 miles/year, but in the worst lightning areas this may rise to 60 faults/100 miles/year. The cause of faults on the systems described in Tables 1, 2 and 3 are given in Tables 4, 5 and 6.

Table 1 gives statistics of a system controlled by manually operated breakers with two-second i.d.m.t. relays, all main line transformers and spur lines being protected with powder-filled fuses of 15 A rating, and the transformers on these lines being fitted with rod gaps set at 2 in. by 1¼ in. It will be seen that during the last two years

920 faults were suffered on a system just over 1,000 miles in length, generally operating in an area of low isokeraunic level. Most of these interruptions occurred on spur lines where fuses blew during lightning storms, causing lengthy interruptions to supply. Faults on the main lines were few, but a large proportion were persistent, leading to lengthy outages. One-quarter of the faults occurred on major sub-station plant and two-thirds on earthed equipment.

In Table 2, figures are given for a slightly smaller system, controlled by high-speed tripping and reclosing breakers with h.r.c. powder-filled 15 A fuses on spur lines and main line transformers, the latter having rod gaps set at 2 in. by 1¼ in. The number of permanent faults on the main lines has been reduced considerably and high-speed reclosure resulted in almost negligible inconvenience to consumers on 145 and 188 occasions for the periods under consideration. Over 90% of the reclosing operations were successful. The number of supply interruptions on the spur lines controlled by pole-mounted reclosers has been notably reduced, but interruptions on fused spur lines remain very high. The time taken for fuse replacement also remains relatively long.

Table 3 pertains to a system 245 miles in length controlled by high-speed tripping and reclosing ground- and pole-mounted breakers only, all fuses having been removed from spur lines and transformers. The settings of the rod gaps on the transformers in this section have been reduced to 2 in. by 1 in. This system is in the area of highest lightning storm frequency, but in 1960 only 20 of the 143 faults were persistent, and the interruptions to supply of over one second were only 6·9 and 5·5/100 miles/year for the two types of circuit-breaker. This experience compares with 52·2 on the conventional system (Table 1) and 52 and 12 (Table 2) where high-speed breakers and fuses were used, the latter figure being much lower because fewer fuses were used on the system controlled by pole-mounted reclosers.

An indication of the advantages of high-speed tripping is obtained by comparing the persistent faults shown on the main lines controlled by i.d.m.t. protection in Table 1, i.e., 16·8 and 9·3/100 miles/year, and those in Table 3, where high-speed tripping is used on the whole system and for which the figures are 5·15 and 6·9/100 miles/year.

Changes in the large bird population, gales and lightning storm frequency are factors which influence the results obtained in Tables 1, 2 and 3 from year to year. In Table 1, for instance, the interruptions to supply per 100 miles of spur line per annum rose to 91 in 1960, almost solely due to the increase in lightning storms, as shown in Table 4. By reference to these Tables, an estimate of the results attainable by each type of system in any other area can be obtained. For example, in Table 3 the figure of 6·9 faults/100 miles/year in 1960 would have been 5·05 had the lightning faults shown in Table 6 fallen by one-half.

Comparison Between Conventional and Solid Systems

The whole area was affected by very heavy and sustained lightning storms between 25 and 27 August, 1960, which caused widespread damage to the 11 kV network, and although the number of 11 kV fuse installations had been drastically reduced, 548 sets had to be replaced. This factor and the loss of telephone communication caused delays in restoring supplies. Fig. 5 shows the 11 kV network in Kirkcudbrightshire, which has been extensively developed over the whole county, and has 90% of the domestic consumers and 98% of the farms connected. The lightning storms here were exceptionally severe, and the whole system was repeatedly hit. The overhead mains are almost equally divided between the conventional system, which has fused spur lines, and a system which is run solidly connected with high-speed reclosing oil circuit-breakers. It is thus possible to obtain a direct comparison of results on the two types of system control. The 11 kV mains total 525 miles and the design is fairly standard throughout, main lines being of unearthed wood-pole construction with conductors at 5 ft spacing in triangular formation, while the spur lines are to BS 1320 or similar type of construction.

Solid System

The 245 miles of line in the solid system network is controlled by high-speed tripping and reclosing breakers and pole-mounted reclosers. All 11 kV fuses have been replaced by solid links and the 700 transformers fitted with rod gaps set at 2 in. by 1 in. The majority of the substation breakers are protected by thyrite surge diverters.

The system was repeatedly hit by lightning, and the reclosing breakers operated 85 times, 66 being recorded on the ground-mounted and 19 on the pole-mounted reclosers. Five persistent faults occurred, and these included one

Table 4. Details of Fault Performance of Network—Conventional System with Fused Spurs

	1959			1960		
	Persistent	Transient	Faults/100 miles/year	Persistent	Transient	Faults/100 miles/year
Lightning ...	21	252	26·4	41	413	42·5
Birds ...	6	11	1·6	—	5	0·5
Gales ...	10	4	1·4	8	2	0·9
Other Causes	26	35	5·9	1	85	8·1
Total = ...	63	302	35·3	50	505	52·2

Table 5. Details of Fault Performance of Network—Auto-reclosing O.C.B's with Fused Spur Line

	G.M. H.S.A.R. O.C.B's						P.M. Reclosers					
	1959			1960			1959			1960		
	Persistent	Transient	Faults 100m/year	Persistent	Transient	Faults 100m/year	Persistent	Transient	Faults 100m/year	Persistent	Transient	Faults 100m/year
Lightning	16	73	12·9	13	285	41·0	7	33	12·9	4	10	4·1
Birds ...	2	5	1·0	5	16	2·9	—	6	1·9	—	4	1·2
Gales ...	4	5	1·3	6	1	0·9	1	2	0·9	3	—	0·9
Other Causes	6	22	4·1	—	35	4·8	2	4	1·9	—	20	5·9
Total ...	28	105	19·3	24	337	50·0	10	45	17·7	7	34	12·1

Transient reclosing operations not included since these are cleared in under 1 second.

Table 6. Details of Fault Performance of Network—Auto-reclosing of O.C.B's with Solidly Connected Spurs

	G.M. H.S.A.R. O.C.B's						P.M. Reclosers					
	1959			1960			1959			1960		
	Persistent	Transient	Faults 100m/year	Persistent	Transient	Faults 100m/year	Persistent	Transient	Faults 100m/year	Persistent	Transient	Faults 100m/year
Lightning	1	33	2·6	9	73	3·7	—	25	—	3	31	5·5
Birds ...	—	—	—	2	12	0·8	—	—	—	—	—	—
Gales ...	—	1	—	1	10	0·4	—	5	—	—	—	—
Other Causes	1	2	2·6	5	28	2·0	1	—	4·3	—	13	—
Total = ...	2	36	5·1	17	123	6·9	1	30	4·3	3	44	5·5

Transient reclosing operations under 1 sec not included in Faults 100m/year.

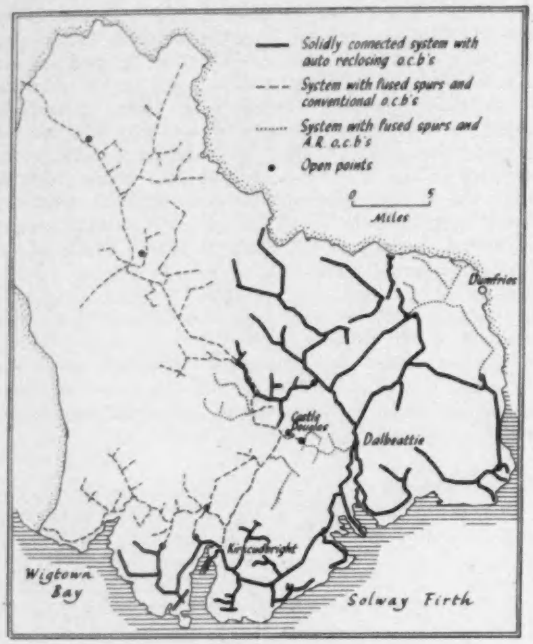


Fig. 3. 11 kV network in Kirkcudbright district, showing three different protective systems

pole-mounted underground cable box, one severed conductor and three pole-mounted transformers, of which one flashed-over to earth internally, the rod gaps showing no flash-over marks, the other two both showing burn marks on the rod gaps and flash-over between turns.

Although these persistent faults occurred on fairly long lines, averaging 42 miles, the faults were located and isolated in an average time of 1·45 hr. This was achieved by the use of radio communication between switching personnel and the control centre, demonstrating effectively that with the solid system working it is possible to concentrate staff to ensure the speedy isolation of any fault. Operating staff, having been relieved of the necessity of organising the replacement of a large number of fuse equipments, can be more effectively used in repairing damage to the system. The total number of consumer hours lost during this storm was 4,200. One distributor emanating from Dalbeattie substation was hit no less than 23 times and, although no permanent faults were sustained, it was found that of the 87 transformers connected, the rod gaps on seven had flashed-over, two of them having operated several times and requiring replacement.

The 280 miles of line in the conventional system is controlled by breakers with two second i.d.m.t. relay protection, the main line transformers and spur lines being protected by powder-filled fuses, and the rod gaps of the 471 transformers connected being set at 2 in. by 1½ in.; 141 incidents were recorded, 15 on the main lines and 126 on spur lines. The outages on the main lines were caused by five persistent and ten transient faults. The persistent faults were due to damage caused by lightning to the following items of equipment: one 11,000/110 V v.t., one 500 kVA transformer, one o.c.b., one overhead line conductor severed, and one set of 11 kV fusegear. Of the 126 incidents on the spur lines, five persistent faults were recorded, all due to lightning damage on pole-mounted transformers. In the remaining 121 cases, the supply was restored by renewing the h.v. fuses; 250 fuses were replaced in all, 17 of these having shattered.

Due to the dislocation of telephone services, consumers were prevented from notifying the control engineer of supply failure and the replacement of fuses on spur lines was badly delayed: 5,000 consumer hours were lost on the main lines and 4,000 on the spur lines, a total of 9,000, compared with 4,200 on the solid system. The cost of replacing fuses alone in this section was £750.

Maintenance of Breakers

The operational performance of the various makes of ground-mounted breakers in service on the high-speed tripping and reclosing cycle is better than could have been anticipated. Contact deterioration has been reduced considerably, and carbonisation of the oil has been less than before. The condition of the units after three reclosures shows a marked improvement to similar units working on a slower timing cycle, probably due to the reduced pre-arc contact heating time. This factor alone justifies the use of high-speed tripping, and it ensures a greater degree of safety for the operational personnel. On transient faults, the contact damage and oil deterioration is so slight that the permissible number of reclosures before overhaul could probably be considerably increased. On persistent faults, however, the normal routine maintenance and overhaul is recommended after three operations.

Precisely the same remarks apply to the pole-mounted recloser and there seems no reason why, assuming normal frequency of operation, the breakers should need maintaining more frequently than once in four years or when the overhead line is normally maintained.

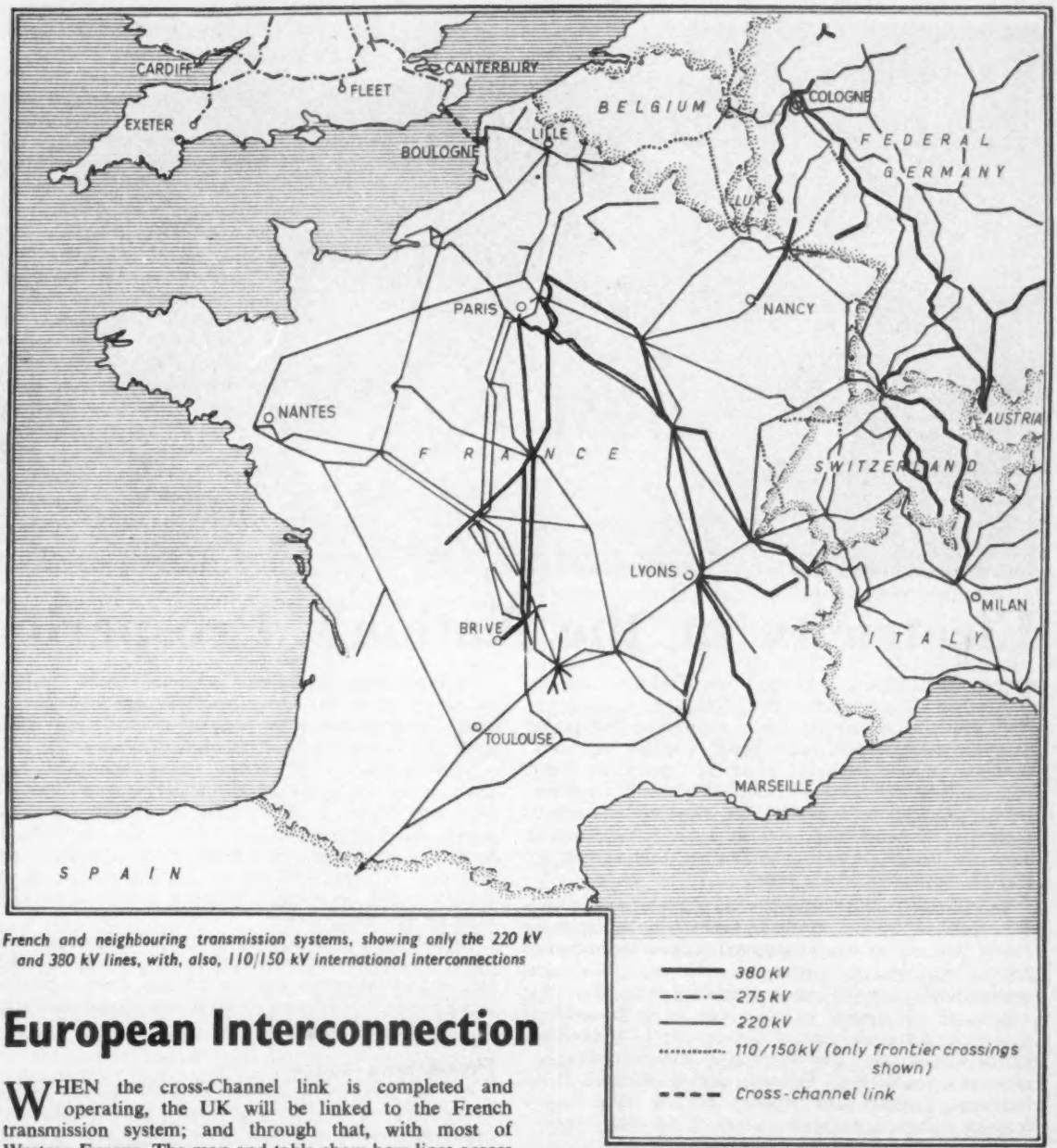
(To be concluded)

100,000 PER CUBIC FOOT

"MICROMINIATURISATION" is defined, for the purposes of one paper being presented this week at the International Conference on Components and Materials used in Electronic Engineering, as "the design of electronic circuits and systems having component parts densities greater than 10^5/cu ft." Sir Willis Jackson, D.SC., M.I.E.E., F.R.S., in his opening address at the IEE last Monday, commented on the fact that this figure, astonishing as it might seem, represented the minimum number and that engineers in the industry were already aiming for 10^6 and even higher densities. These developments, chiefly in the electronic fields of telecommunications, computers, and guided missile control, had been the result of applying and using new materials having particular properties which were barely known a few years ago, and already their influence was extending outside the small current field into the realms of power engineering.

Though miniaturisation owes its concept to the guided missile field where resistance to vibration and sudden accelerations are vital but life is short, its influence extends to deep sea cable repeaters where reliability over many years without attention is essential.

The conference, which is being attended by delegates from all over the world, will discuss more than 100 papers which have been prepared for the occasion and which will be introduced in 16 sessions held in the Lecture Theatre and the Faraday Room at the IEE, London, until the conference ends on Friday next, June 16. A survey of some of the papers and the discussions will be given in the ELECTRICAL TIMES next week. An exhibition of components, materials and electronic equipment by British manufacturers is on display daily in the Kelvin Room.



French and neighbouring transmission systems, showing only the 220 kV and 380 kV lines, with, also, 110/150 kV international interconnections

European Interconnection

WHEN the cross-Channel link is completed and operating, the UK will be linked to the French transmission system; and through that, with most of Western Europe. The map and table show how lines across frontiers link the Electricité de France system with those of neighbouring countries. At present, the capacity of interchange is relatively small. It is co-ordinated through the "Union for the Co-ordination of the Generation and Transmission of Electric Power," UCPTE, which includes Austria and the Netherlands, besides France and those shown in the table.

In France, E de F is responsible for all the transmission, although there is some independent generation which is co-ordinated by E de F. The French network is operated interconnected and synchronised. There is a national control in Paris and eight regional distribution centres, each with one or more load dispatchers.

The map and the table are based on information published by the CEGB, UCPTE and the Committee on Electric Power, UN Economic Commission for Europe.

European interconnections with the French E de F system at July, 1960

Interconnection with:	H.T. line parameters			Increases planned or under construction
	Voltage kV	Total number of circuits	Thermal limitation MVA	
Switzerland ...	130	1	50	
	150	8	490	
	220	1	230	1,070
	225	2	300	
W. Germany ...	110	2	130	Uprating to 160 MVA
	150	2	197	557 Uprating to 314 MVA
	225	1	230	
Belgium	150	3	260	
Italy	70	2	40	
	225	1	140	180 Uprating to 90 MVA
Luxembourg ...	65	2	30	
Great Britain ...	—	—	—	220 kV d.c. 160 MW submarine cable

E•

Electricity in the Nation's Prosperity

EASTBOURNE has this week been filled with delegates to the thirteenth British Electrical Power Convention, which, under the presidency of Sir John Pickles, has been considering papers on a number of supply and manufacturing subjects, presented under the Convention theme, "Electricity in the prosperity and welfare of the nation." Once more, this is a Convention without the electrical exhibition that used to provide an out-of-session meeting place for delegates; and it follows the four-day pattern that has applied in recent years.

The business of the Convention as a whole began with a civic welcome by the Mayor of Eastbourne and then Sir John's delivery of his presidential address (summarised below) on Monday afternoon. However, delegates representing the supply industry had been busy before that with a private meeting at which two main themes were discussed, "Research," introduced by Mr L. Rotherham, of the CEGB; and "The Finance of Electricity Supply," introduced by Mr R. S. Edwards, deputy chairman of the Electricity Council. On Monday evening there was a mayoral reception, pictured in some of our illustrations.

The first of the Convention papers to be read and discussed was concerned with the transmission system and was presented by Sir Christopher Hinton (CEGB) (page 946) on Tuesday morning. It was followed in the afternoon by a paper on aspects of efficiency and economy in distribution, by Mr R. R. B. Brown (chairman, SEB) (page 948).

Wednesday morning saw a departure from usual Convention programmes, and one full of interest. Dr A. E. Grauer, who is president of the British Columbia Electric Co. in Vancouver, Canada, presented a paper to the Convention describing the electrical power industry in the Dominion as a whole, and discussing some of its plans and its problems (page 952). In the afternoon, Mr S. F. Steward (director, BEAMA) delivered the last of the Convention papers, a survey of the place of British electrical manufacture in the national economy, and an estimate of its prospects (page 951).

On Wednesday evening the Convention dinner was held, and this morning the Convention closes with an "electrical forum" question and answer session and the a.g.m., all of which will be reported in these pages next week.

Sir John Pickles, B.SC., M.I.E.E., the president, has been chairman of the South of Scotland EB since 1955. He took his degree at Manchester University and then joined the Yorkshire Electric Power Co. In 1931 he became county electrical engineer of Dumfries and remained in that position until nationalisation of the industry, when he became chairman of the South West Scotland Electricity Board.

Sir John was president of the BEPC's forerunner, the Incorporated Municipal Electrical Association, in 1947. His work in the supply industry has been marked by close attention to the problems of developing the electrification of rural areas.

Presidential Address

For his presidential address Sir John chooses to look to the future of the electrical industry, offering predictions as far ahead as the year 2000. This he does after surveying two earlier 40-year periods, those ending in 1920 and 1960.

In the period 1880 to 1920 the industry grew slowly, severely hampered in the earliest days by legislation that offered little encouragement to enterprise. By 1920, however, about 4,000 million kWh was sold in a year. The largest generating set was 25 MW rating, and the highest transmission voltage 22 kV. Coal consumption was about 3 lb/kWh generated.

From 1920 the pace quickened, with the establishment of the Central Electricity Board and the creation of the grid particularly significant. Today, corresponding to the figures given for 1920 are over 100,000 million units sold a year, sets of 200 MW rating and transmission voltages up to 275 kV. Coal consumption is under 1 lb/kWh. Thus, over 40 years, consumption had increased by a factor of 25, transmission voltage 12 times and individual set ratings three times. In Sir John's phrase, "electricity has developed from a luxury to a necessity."

Load Growth Ahead

Today, the all-electric home in the full sense of the term is with us. Housing programmes include a significant and growing proportion of dwellings in which no fuel other than electricity will be used. The same trend is to be seen in commercial and public premises.

In the immediate future, Sir John thinks that the Clean Air Act will have a particularly strong impact on electricity consumption. Over the next 10 or 15 years, the Act is likely to result in at least six million existing buildings changing from the burning of raw coal to prepared smokeless fuels, electricity amongst them. He doubts whether the industry has realised the full potential of the electrical load involved. From experience with the first of the smoke control areas, he estimated that electricity will be chosen as the sole fuel for at least half the houses. Such a choice involves an additional after-diversity demand of at least 1 kW/house. That suggests a possible increased demand of 3,000 MW from domestic heating alone, subject to what can be supplied off-peak when suitable domestic heaters are available.

From this and other considerations, Sir John offers a prediction for the years up to 1970. Immediately, he is up against the "double every ten years" rule for electricity consumption. Can this rate of increase be expected to continue? So far as the decade to 1970 is concerned, the more detailed estimates prepared by various electricity authorities suggest that it will.

How about the next decade? For this purpose Sir John looks at some UN Economic Commission for Europe figures for 1975. Based on 100 for electricity consumption in 1960, the index for France in 1975 becomes 286, for West Germany 255, and the USA 203, against 230 for the UK. But the report on which these figures are based warns that long-term estimates of electricity demand tend to be conservative. For example, the US figures showing doubling in 15 years are those of the Federal Power Commission, but markedly higher estimates have been submitted to a US Senate committee by other US authorities.

The present average level of UK consumption, slightly over 2,000 kWh/year, is less than one-half the US figure and only one-third that of Canada. Even after allowing for the difference in geographical and economic climate, there seems room for a continued fast rate of expansion in the UK. Moreover, the UK population is likely to have risen by 10% by 1980. Sir John concludes that "it does not seem at all impracticable for the 1970 consumption to be doubled again, possibly by 1980 and certainly by 1985."

Technical Requirements

Next, Sir John looks at the implications of this prediction. In generation the installed plant aggregate will have reached 100,000 MW, against today's 32,000 MW. Moreover, there will be a substantial replacement programme to meet as well as that for the expansion. The coal availability ceiling will have been passed, which suggests that the majority of the new generating plant will have to be nuclear; although conventional plant may be economically preferable in many cases, especially for replacement in existing buildings. The 1,000 MW set may have made its debut, and 750 kV transmission seems a possibility.

In the distribution field, increased demand will have forced extended h.v. systems, with h.v. transformers for groups of 20 or so houses. This will demand transformers of improved compactness and reduced noise levels. L.V. cables will be of extruded plastics materials, perhaps without metal sheaths. With the high loads expected from individual buildings "there must be a development round the corner that will bring supervisory control of consumers' installations back into its own." With increasing dependence of the consumer on electricity, continuity of supply will become even more vital.

Sir John Pickles, B.Sc., M.I.E.E., president of the thirteenth BEPC

Meter readings made only once a year are amongst Sir John's hopes for 1980. Moreover, the industry as a whole will, in his view, approach and possibly attain a position of complete self-financing, with all new capital requirements met from earnings.

Turn of the Century

For the next 20 years to 2000, Sir John admits that it is easier to pose questions than to make predictions. Assuming that 100,000 MW of plant is installed by 1985 (not before) and assuming an expansion rate of only 3%/year after that, then more than 150,000 MW is to be expected by the turn of the century. A 5% yearly increase gives a total in excess of 200,000 MW.

In the face of these figures, the vital question is, what fuels will be available? He is certain that those in charge of the supply industry will be feeling the pinch of a shortage of coal and oil by the mid-1980s. Nuclear energy should provide the answer, but whether it will be fusion or fission is less certain. However, Sir John makes the point that if fission is sure to provide a cheap and reliable form of generation, it may be argued that the enormous cost of research and development in the field of fusion reactions may not be justified.

Of the various methods suggested for the direct conversion of heat to electricity without intervention of a steam cycle, Sir John dismisses thermionic and thermoelectric generation and the fuel cell as techniques of the next century, outside the scope of his review. But the idea of magnetohydrodynamics he finds more promising, especially because fission may prove highly suitable as a heat source for use with it.

In concluding his address, Sir John speaks of the industry as throbbing with vitality. It has an assured and seemingly insatiable demand for its product, and at the same time technical advances are decreasing its costs in comparison with competitors. "To meet prospective expansion," he says, "means a long pull and a steady pull on the part of everyone." Society will not tolerate restriction in a service so vital to the nation's prosperity and welfare.

Developments in the transmission system

Sir Christopher Hinton, chairman, CEGB

BRITAIN'S transmission system in the future is likely to be based on a 700 kV large-mesh network superimposed on a 400 kV/132 kV system. This follows from the CEGB's studies of future requirements, says Sir Christopher Hinton in his paper on "The British Electricity Transmission System."

Up to the present, maximum demand on the CEGB system has been 24,449 MW, imposed in December last. This demand may be trebled in 15 to 20 years' time. By then there is likely to be a heavy concentration of power stations in the central British coalfields, with other groups in North Wales, the Severn Estuary, the Bristol Channel, Central South Coast, the Thames Estuary, South East Kent and the East Anglian coast. About two-thirds of the peak demand supplied from power stations will be used in Greater London, the South West, Midlands and North Western areas.

With this pattern of supply and demand, a general level of movement of power in 4,000 MW "packets" over distances of 50 miles to 100 miles is envisaged. Transfers as high as 8,000 MW will occur from the central coalfields towards the South Midlands, with 6,000 MW continuing to the London area, distances of 100 miles to 140 miles. In round figures, in an average cold spell a national demand of 70,000 MW is expected, using the 400 kV supergrid to the full. Nuclear generation is expected to account for about 30% of total consumption of electricity in terms of coal equivalent. Movement of coal over long distances by rail will have virtually ceased, and transport of coal by sea dropped to about half its present total.

The problem of transmission voltage has had careful study within the CEGB. Selection of a 420 kV system, with nominal voltage 5% less, permits conversion of existing 275 kV heavy duty lines for operation at the higher voltage. If a voltage such as 500 kV had been adopted, uprating of existing lines would not have been possible. It would have been necessary to retain an extensive 275 kV grid and superimpose a 500 kV network.

The cost of terminal equipment for 500 kV is higher than for 400 kV, and the saving in cost per mile of overhead line for equivalent capacity is not sufficient to outweigh this factor. Only at transmission distances greater than 160 miles is transmission at 500 kV likely to be cheaper than at 400 kV.

A further consideration taken into account in deciding on 400 kV as a new transmission voltage is that by 1975 700 kV should become practicable as a transmission voltage. Research to ensure that this is so has been put in hand. After 1975 it should be possible to superimpose a 700 kV large-mesh network on the 400 kV/132 kV system.

Sir Christopher does not confine himself to such broad overall transmission planning. His paper also discusses what he calls past and present imperfections in the field of transmission. It is not easy to forecast exactly where bulk supplies will be required by a given date. As a result, transmission planning has included a good deal of improvisation to meet any unforeseen news. Such *ad hoc* planning is likely to be technically uneconomical, and it may also cause unnecessary offence against visual amenity. In this context there is an argument for revising the point of demarcation between lines that are the responsibility of the CEGB and those belonging to the area board from the present 66 kV up to 132 kV. Indeed, it is possible that only by such a change can the CEGB avoid taking the responsibility for the direct supply to industrial consumers whose demands justify their connection to 132 kV lines.

Until recently, construction of transmission lines and equipment by the CEGB offended against what Sir Christopher calls a "cardinal principle in the construction of new works." This is the appointment of one man responsible for seeing that the project is designed wisely to meet the stated requirement and that it is completed by the required date within the sanctioned cost. A recently introduced change in CEGB practice places responsibility for most transmission schemes with the five regional organisations. Only schemes which extend across regional boundaries will be wholly the responsibility of a headquarters department.

On the question of amenity, Sir Christopher says he does not believe that the British public will tolerate an indefinite extension of the transmission and distribution network which gives an effect that can be described as a wirescape. On the other hand, to underground the additions to the transmission network which he foresees, would cost over £100 million a year, equal to 20% extra on the bulk supply tariff.

In terms of tactics, advantage should be taken of the fact that the British public does not differentiate between transmission and distribution systems. Although the undergrounding of distribution systems increases their cost, the difference is not so great as with the h.v. transmission system. The delivered cost of electricity is likely to be kept at its lowest if the pressure of what Sir Christopher calls "conservationists" on the transmission system is relieved by reasonable concessions to them in relation to the distribution network.

Switching stations are a particularly difficult problem from the amenity aspect. They are almost always alien to their surroundings. The first problem is the positioning and orientation of the site in relation to the lines that served it. Despite the cost of undergrounding, terminating transmission lines in a final half-mile of cable may be justified. However, the problem arises that the electrical structures used in substations forbid more than a limited amount of design freedom. If the substations are put indoors (at an increased cost of between 10% and 30%), large buildings are needed, which, for technical reasons, ought not to have windows or be built of brick. Thus, they tend to be large featureless boxes.

1. Sir Robertson King welcoming delegates to the Supply Industry private conference on Monday morning. 2. Delegates in the "Floral Hall." 3. Left to right: delegates arriving Messrs D. R. Williams, A. Haddock, W. E. B. Nettleton, F. A. Ellis and C. Booth. 4. R. J. Rennie, J. E. Peters and W. E. Gibbs. 5. H. R. Farries, H. J. Harley, R. J. H. Harley and S. A. Rushley. 6. T. E. Daniels, S. Dodd, W. C. Parker, J. E. Peters and K. C. Thompson. 7. H. I. Hulme, C. H. A. Collyns, H. B. Bruce and W. H. Wills. 8. E. Forth and R. G. Bellamy. 9. R. G. Monk, J. W. Trimble, S. Fairclough and A. M. Riley. 10. L. H. Palmer and L. G. Moser. 11. R. Baldwin, G. S. Buckingham, W. J. English and P. M. Wilson. 12. J. Aitken, W. Gallon and G. C. A. Mann. 13. G. E. Pearson, G. G. Cooper and R. S. Atkinson. 14. D. Bellamy and J. Henderson. 15. R. H. Coates, P. Briggs and A. R. Cooper. 16. R. S. Atkinson, C. Morley New and S. H. Ball. 17. D. I. Worthington, G. D. Worthington and W. J. Forster

Seeking economies in distribution design

Mr R. R. B. Brown, chairman, Southern Electricity Board

ABOUT £100 million a year is spent on additions to the area boards' distribution systems. Clearly, one of the principal tasks of the area boards is to ensure that the money is well spent, through economic system planning and design. That provides ample scope for the paper by Mr R. R. B. Brown (chairman, SEB), on "Some Aspects of Efficiency and Economy in Distribution"; and he adds to it some ideas for improving distribution.

For many years boards have had to face restriction in their spending on distribution, and reinforcement work has suffered particularly severely. This is taking its effect today in heavy spending on reinforcement as distinct from other distribution projects. No less than 45·4% of 1959-60 capital spending on distribution by English and Welsh area boards fell under this heading. Yet it is probable that, with the above-average rise in demand, little inroad is being made into the backlog of reinforcement work necessary to correct voltage and avoid overloading plant. Shortage of capital has also hampered standardisation of systems of supply.

Supply Security

In planning distribution systems, it is axiomatic that close attention must be given to maintaining continuity of supply. Yet complete security of supply can only be provided at quite uneconomic cost. How far the industry is justified in spending more money to improve continuity is posed by Mr Brown as "an important question." He concludes that the point of balance is quite different in rural and urban areas. Outages in overhead lines are usually (75% of all cases) due to transient faults without permanent damage. Petersen coil protection offers many advantages in preventing outages from single-phase faults, but increasing use of unearthed lines is making this technique less effective. High speed auto-reclosing circuit-breakers cost more, but have advantages which fully justify their first cost.

Lower security may have to be accepted by the area boards in terms of bulk supply as well. Acceptance of a

1. Sir John Pickles delivering the Presidential address. Delegates arriving at the opening of the Conference. 2. Sir Maxwell Ingliss, C. T. Melling and ladies. 3. Messrs C. L. C. Allan, F. J. Lane, J. Henderson and ladies. 4. Mr and Mrs C. B. Cleland with S. G. Nimrod and lady. 5. O. W. Humphries, Mr and Mrs W. J. Bird. 6. Cable industries group including Messrs F. Waine, E. J. Vidler and ladies. 7. Cmdr D. S. E. Thompson, Mr N. R. Elliott and Brig Chapman. 8. Mr P. L. Carnell and Brig W. G. S. Thomson. 9. Sir Christopher Hinton. 10. Mr and Mrs S. E. Goodall

1. Sir John Hacking being received by the Mayor at the Monday evening function. 2. Sir William McFadzean and Lord Citrine. 3. Sir Hamish and Lady MacLaren. 4. Messrs E. B. Sawyer and K. S. Estlin. 5. Dr J. N. Aldington, Sir Christopher Hinton and ladies. 6. Messrs L. C. Penwill, G. N. Walker and ladies. 7. Messrs J. H. Hirst and E. H. Maltby. 8. Mr and Mrs R. Preston

single transformer initially at a bulk supply point, wherever there is emergency transfer capacity at sub-transmission voltage from another bulk supply point, offers considerable economies. Overall, a look at distribution costs strengthens the case for 132 kV replacing 66 kV and 33 kV as the main distribution voltage within an area board.

Lines and Cables

Much economy is possible in overhead line distribution. The wood pole lines with unearthed steelwork to BS 1320 cost, for the representative case of a 0·025 sq in., three-phase line, only 15% of what they would have done under the first BoT regulations of 1907. So far as conductors are concerned, changes in metal prices have stressed the advantages of aluminium. With copper at £230/ton and aluminium at £185/ton, a saving of about 20% can be made in a l.v. four-wire 0·1 sq in. copper equivalent line if plain aluminium is used instead of copper. The short spans necessary in l.v. distribution mean that there is no advantage in s.c.a. or aluminium alloy conductors. Mr Brown comments, however, that the initial savings must be discounted to some extent by the probable longer life of copper and the fewer operational troubles it introduces, particularly with joints.

Line costs are increased at special positions, such as crossings over railways and PO lines. Collaboration is now reducing the demand for expensive protective construction, such as cradles. There is also more joint use of poles, and there is a probability that this will be extended in the near future to permit joint-user construction with 11 kV lines.

Single-wire earth-return wires have been used in sparsely populated parts of Canada and Australia. Some research has been carried out in the UK, but so far too few lines have been erected to permit definite conclusions. However, Mr Brown thinks that this system could be used with advantage to supply isolated premises situated at a considerable distance from existing h.v. mains.

There have been many advances in cable design to help distribution engineers. At 33 kV and above, oil- or gas-filled cables show some capital saving compared with the solid type. Aluminium has come into wider use, although corrosion can produce troubles; and difficulties with soldering or compression jointing have not yet been thoroughly mastered. Solid sector aluminium cable may also find many applications resulting in reduction of first cost, once jointing problems have been fully overcome.

New types of p.v.c.-insulated cables are being tried out in distribution systems, and it appears that a concentric p.v.c. service cable has much to recommend it. There are also advances in jointing such cables, cutting only a few of the wires of the distributor core to make a T-joint. Unarmoured p.v.c. cables have been used in Australia, and are being tried in the UK. If experiments are successful, important savings may result.

Transformers and Switchgear

So far as transformers are concerned, iron losses have been reduced by the use of c.r.g.o. steel. Where transformers are installed at a substation, there are economic advantages in using two full-rated transformers to provide supply security, rather than three half-rated transformers. Further economy could be achieved by using a common cooler bank rated for one of the transformers only. Noise from transformers has become a serious problem, but manufacturers have made improvements by using integral cladding of metal plates suspended from the cover and lined with sound-absorbent material. In a typical case, a reduction of 12 dB in noise level of a 15 MVA transformer is claimed to be possible. Buried transformers are now available. They cost from 30% to 75% more than for a normal overhead unit, apart from the cost of excavation and ground reinstatement, but the extra cost is usually more than offset by the saving in the cost of a brick building and additional cable work.

In major reinforcement schemes, switchgear and ancillary equipment may account for more than one-quarter of the total cost. The amount of switchgear required has been

reduced by using 33 kV air-break switches with interrupter heads for the control of transformers, using 33 kV fault throwing switches on transformer feeders, and using teed transformer feeders with transformers controlled either by indoor non-automatic oil switches or outdoor air-break switches with interrupter heads.

Much saving is possible by ingenuity in substation design. At 33 kV, the lowest costs are achieved by using fully outdoor equipment with busbars and connections supported by r.c. structures. In built-up areas, where the necessary large sites are not available, increasing use is being made of packaged gear instead. In the case of one Green Belt substation where the only alternative was a brick building, a saving of at least £20,000 was obtained by using packaged gear. Capital economies of 40% have been achieved by using outdoor type distribution substations in the place of indoor type. In this case, the outdoor transformer is controlled by a ring main unit.

Load Factor

With distribution equipment installed at the lowest possible cost, it becomes necessary to make the fullest possible use of it. The annual load factor of the CEGB system adjusted to standard weather was 47·4% in 1960, having climbed from 42·7% in 1948. However, this figure has to be considered against a load factor which is 70% over the 24 hours of a working day; over the 168 hours of a week, 63%; and over a month, 60%. Again, since the load is growing at about 7%/year, the apparent load factor is reduced by about 3% of its value. The major factor lowering annual, compared with weekly or monthly, load factor is the shorter daylight hours and lower temperature of winter compared with summer.

Mr Brown devotes much of the latter part of his paper to a consideration of developments in control and design of appliances which can improve load factor.

Tariff incentives can help increase the use of electricity off peak. Special arrangements offered to industrial consumers willing to curtail demand during winter daytime peak and to electrical floor-warming consumers are known to have resulted in at least 2,000 MW being kept off peak. Floor-warming, block storage heaters and electrode boilers account for 1,300 MW of this, and large industrial loads kept off peak for another 700 MW. But there is a sharp limit to what can be done by tariff adjustment, since costs of power supply represent so small a part of the total cost of a manufactured product.

The tariff advantage of any off-peak supply is offset in part by the rental charge for the time switch and contactor necessary to control the supply. Mr Brown sees possibilities of improvement in this respect, especially in the control of contactors for several consumers from a single time switch at a substation, using a pilot wire in the cables.

On block storage heaters, Mr Brown comments that they may find wide application in domestic premises if they are freed from purchase tax. However, they will be more acceptable to householders if the heat output can be controlled. There is a possibility of achieving this by using a fan to blow air over the storage blocks, and the possibility is being investigated of a trial of large heaters designed with this feature.

Discussion on Transmission and Distribution Papers

INTRODUCING his paper, Sir Christopher Hinton said it was a mistake to think of transmission as a junior partner of generation. Transmission was perhaps the dominant. In the past, attempts had been made to trim the transmission system too closely to the demand. Transmission in fact gave the only flexibility in the electrical system.

The discussion on the paper was opened by Mr J. D. Peattie, who said that the industry had never lacked men of vision so far as amenity was concerned. Engineers had to try to avoid offending the conscience of their fellow men by their work.

Mr S. Z. de Ferranti was critical of the way load growth was so frequently underestimated. Because of this the 275 kV system had sufficed only for about ten years. So far as the design of transmission systems was concerned, he thought more use should be made of digital computers. They might also be more closely integrated into system operation.

Mr N. Elliott suggested that one overhead line properly designed and landscaped was not objectionable aesthetically; two lines together, not properly designed, might be objectionable; three lines together were objectionable in any circumstances. He thought that before the year 2000 everyone might have their own nuclear reactor to provide heat and electricity for the home.

Mr R. M. Fairfield, speaking as a cable maker, suggested that improvements in cable design could reduce the ratio of cost of underground cables compared with overhead lines. Use of conductors as large as 2 to 4 sq in. gave a reduction of 30% on the ratios usually quoted by the CEGB. A further saving would be possible by according a higher winter rating to cables.

Mr I. M. E. Aitken was critical of the costs quoted in public enquiries by the CEGB for undergrounding. These did not take into account all developments in cable design and they assumed an unreasonably high underground cable rating as necessary to give the equivalent of the o.h. line.

Mr C. J. O. Garrard thought there was a case for a central government contribution when costs to meet amenity considerations became greater than the lowest cost of carrying out transmission. Mr Paton spoke of pressure on engineers in rural areas to give a maximum number of supplies at the lowest cost. Mr H. W. Mitchell thought that attention should be given to the possibility of reducing tower sizes for 400 kV.

Mr H. J. Beard described an indoor substation based on the use of large vertical busbars. This had been designed for 275 kV but could be developed to 400 kV. He thought that the thermal ratings of overhead lines could be increased considerably with safety. Mr F. J. Lane was critical of the decision to go only as far as 400 kV for the next step in transmission. He thought an immediate move to 600 or 700 kV might be justified.

The discussion on Mr Brown's paper was opened by Mr R. S. Edwards, who said that for a considerable period area boards had not been allowed to invest enough capital. That had encouraged ingenuity but it had sacrificed the best long term investment planning to short term necessity. The optimum use of resources had been frustrated. It was imperative that the utmost should be done by study to understand the economic problems of the Industry. Further, it was uncertain whether cost research was attracting enough effort, and whether the results of it were becoming known widely enough in the industry.

Some subsequent speakers (the discussion will be reported in more detail next week) argued that there were disadvantages in having a published bulk supply tariff.

Electrical manufacturing looks ahead

Mr S. F. Steward, director, British Electrical and Allied Manufacturers' Association

ELECTRICAL manufacturing holds a key position in Britain's economy, and some aspects of this situation are examined in the paper by Mr S. F. Steward (director, BEAMA) on "British Electrical Manufacture in the National Economy." His paper is written in the Golden Jubilee year of BEAMA, and in its early part the paper links the Association with the growth and development of the industry in pre-war years.

Today, electrical manufacturing supplies more than one-third of the capital equipment of the country. In addition, electrical exports are of special significance. Although a record total of £293 million in export was achieved in 1960, BEAMA is conscious of the importance of increasing this figure.

A characteristic feature of the electrical manufacturing industry has been its remarkable growth. Taking the BoT index of production for 1948 as 100, the 1960 figure for electrical manufacturing is 229; against vehicles 226, chemicals 213, and all manufacturing industry 159. Employment in the industry has increased only by 40%, indicating a strong rising trend in productivity. Table 1 shows the changing pattern of the industry as regards its manufacturers. Two sections have shown outstanding growth over the last decade, domestic electrical appliances and electronics and communication.

Table 1. Electrical Manufacturing Output

	Percentage of total output	
	1948	1958
Electrical machinery	54	25
Allied plant and equipment		24
Electronics and telecommunications equipment	20	30
Electric wires and cables	19	11
Domestic electrical appliances	7	10

In October, 1960, employment in the industry reached the highest total, 795,800 workers; 28% of these were engaged in electrical machinery manufacture, 38% in electronics and telecommunications. The industry is the largest industrial employer of both scientists and technicians. It is also an extremely heavy invester of capital. In the decade from 1950 to 1959, a total of £378 million was invested, £236 million of it on plant and machinery, £31 million on vehicles and £111 million on new building work. The rate of increase in annual investment over this decade is higher than for other manufacturing industries. However, earnings over the period have not risen to anything like the extent of the capital needed to generate them. In consequence, the return on capital employed is lower than in many industries.

Mr Steward explains this last circumstance as being due to the high cost of maintaining a technical lead, and also because highly competitive trading conditions have placed profit margins under severe pressure. If investment is to continue at a high rate, the efforts of the past few years must produce a full measure of profitable business. "The financial status of this industry is of great importance, and a period of excessive price warfare with inadequate margins could deter investment and produce a dangerous situation from the national point of view."

In the final part of his paper, Mr Steward looks to the future, with particular attention to the coming decade. Taking the power programme first, he expects the reappraisal of where the 6·9% average rate of increase in demand is sufficient for planning purposes. The recent unexpected upsurge in demand will need to be investigated as to its reasons. Pointers occur in statistics of sales of domestic appliances, and increased popularity of space heating. It is difficult to resist the view that the rate of growth of demand will be greater in the next decade than in the last.

In manufacture, adoption by the CEGB of stations of 2,000 MW capacity clearly limits the number of separate contracts any one firm can hope to receive.

Table 2. Estimates of U.K. Home Deliveries in 1965

	1965 estimated home deliveries (000's)	Percentage change 1965 on 1959
Washing machines	1,500	+38
Refrigerators	1,250	+50
Vacuum cleaners	1,500	+ 6
Space heaters	4,600	+60
Irons	1,900	+10
Cookers	600	+26
Immersion heaters	1,100	+57
Hair-dryers	450	+10
Wash-boilers	220	+13
Water-heaters	220	+21
Toasters	190	+10
Floor-polishers	25	+ 9

Mr Steward comments that the CEGB has a task of "extraordinary difficulty" in balancing the advantages of nuclear achievements and conventional plant improvements. In a way, such problems are peculiar to British electrical manufacturing industry.

However, the working relationships and co-operation between the supply industry and manufacturing industry are excellent at all levels. It should be possible to formulate programmes and work out contract procedures that will ensure that the best use is made of the resources available to the advantage of the public interest in every way.

In the domestic appliance manufacture, all the evidence points to steady growth in demand during the next decade. Table 2 gives estimates of how deliveries may grow by 1965. However, such estimates have to be treated with reserve, since it is not easy to assess which appliances will emerge as popular and which remain of marginal interest. The overall picture suggests a total output of the domestic appliance industry of £240 million by 1965 and approaching £340 million by 1970. The import-export position will have an important bearing on this, since competition from imports has increased rapidly.

Electricity supply in Canada

Dr A. E. Grauer, chairman, British Columbia Electric Co. Ltd.

WITH so much attention given to electricity supply and electrical manufacture in the UK, a contribution on supply development in some other part of the world is welcome. This is provided by Dr A. E. Grauer (chairman, British Columbia Electric Co.), in a paper on "The Electrical Power Industry in Canada."

Canada has a surface area second only to that of the USSR, but much of the land mass in the north and to the south between Manitoba and Ontario, and in mountainous British Columbia, is nearly uninhabited. Every second Canadian lives in a relatively compact area along the St. Lawrence River in Quebec and southern Ontario. This feature of a population concentrated in small areas separated by large distances is repeated throughout the country.

A result of this pattern of population is that transmission and distribution of electric power has not been a matter of covering the great distances suggested by the map of the country. The tendency has been for the Canadians in different parts of their country to supply their owns needs, confining their attention in each case to distances of a few hundred miles. Thus the electricity industry remains largely provincial in character, with the manner of organisation varying widely from one province to another. In particular, the extent of public ownership varies widely from one province to another.

Consumption and Tariffs

In 1949, Canadian electricity consumption per residential consumer averaged 4,300 kWh/year. The principal load building appliances have been the electric water heater and the electric cooker. Where these have been developed intensively, city-wide average annual consumptions as high as 8,000 kWh are achieved. On the other hand, competition from natural gas in other areas depresses the average to 3,000 kWh/year.

Domestic tariffs in Canada are largely of the simple block type. Off-peak tariffs are not used to any appreciable extent except for the sale of surplus energy. One reason is that North America largely operates a three-shift industry. A monthly billing cycle is the normal arrangement, with one-twenty-fifth of all meters read every working day. The idea is to keep down the size of the bill. Where space heating is supplied, "budget billing" is sometimes in use, with ten months' consumption estimated in advance and averaged for equal payments, and settlement on actual consumption at the end of the period.

It is reckoned that in spite of the high level of consumption already reached in Canada, power requirements will continue at more than a 6%/year rate, and that construction of about 50,000 MW of new generating capacity will be required by 1980. Finance for this is a problem, but so far, Canadian electricity supply has been largely developed by Canadian money, unlike some of the Dominion's industries.

Turning to Canada's energy resources, he suggests that in the reasonably near future commercial water power potential may be rated between 70,000 MW and 80,000 MW, compared with a present installed turbine capacity of 20,000 MW. Quebec and British Columbia have the largest undeveloped resources.

However, some of Canada's main industrial centres will increasingly have to turn to thermal generation. This is not so distressing a thought as it once was, because of the fall in specific cost of thermal plant, and the rise in that of hydro installations. In a British Columbia station being built by a British company, cost per kW installed will be under $120.

Plans for the Future

So far as nuclear energy is concerned, it seems improbable that Canada as a whole will become interested in the present decade, because of her low generation costs. Southern Ontario is an exception, for many thermal stations will have to be built there after the mid-1960's, and there is relatively little indigenous fuel available. Strip mined coal can be imported from Pennsylvania or Ohio to give electricity at about 6 mills/kWh in Ontario or Hamilton, so this is the cost target for nuclear power stations. It seems possible that the 200 MW natural uranium, heavy water reactor being built in Ontario as an advanced nuclear experiment may approach such costs.

Canada may find special use for nuclear energy in pulp and paper mills, where considerable demands for electricity (30 MW to 40 MW) are accompanied by a requirement for large quantities of heat. The combined effect might be sufficient to make nuclear power economically attractive.

In the final section of his paper, Dr Grauer looks at some of the proposals and problems at present engaging the attention of the leaders of Canadian industry. One is the proposal to export electricity to the USA. The case for export is that there is surplus hydro potential, and that some large schemes could be developed more economically with larger initial markets. The argument against is that nuclear power in 15 years' to 25 years' time may be cheaper, generated near load centres, than hydro power transmitted over long distances (say, 500 miles). There is also a fear that Canada will not be able to "recapture" the exported electricity if she wishes to.

Another problem concerns the possibility of a national power grid, with an east-west run. However, it is thought unlikely that this will receive early implementation unless the Canadian Government takes the initiative for reasons outside the purely electrical. The cost of the 3,000-mile e.h.v. transmission system would be formidable, and Canadian provinces with hydro resources remaining would be unlikely to develop them for national use. Again, other forms of energy can be transported, Dr Grauer thinks, cheaper than electricity.

Readers Views

Correspondents writing under pseudonyms are asked to submit their names and addresses in confidence to the Editor

Truth in Advertising

UNFORTUNATELY some little departure from truth has become acceptable in advertising, but the undersigned firms have reluctantly come to the conclusion that they must immediately correct the wrong impression which may have been gained by your readers from an advertisement which appeared on page 25 of your issue dated 18 May, 1961.

The bold type text of the advertisement reads: *The FIRST ORDER for 400 kV goes to DOULTON Multicone.*

The truth of the matter is that orders were placed on the same day with all four English manufacturers of h.t. porcelain insulators for small quantities of posts for comparative trials on the CEGB's experimental section of 400 kV Grid.

Each manufacturer will supply what he recommends to meet the specification, and it is highly misleading to suggest that one make has been selected before the trials have even started

J. E. Harris,
MANAGING DIRECTOR, BULLERS LTD.
G. O. Britton,
DELEGATE DIRECTOR,
STEATITE AND PORCELAIN PRODUCTS LTD.
G. H. Gillam,
DIRECTOR,
TAYLOR TUNNICLIFF AND CO. LTD.

Neutral Current from Lighting

MR LLOYD'S letter on the subject of "Neutral Current from Lighting" is most interesting and, in addition, confirms many of the points raised in my article of 16 March, 1961. There is no inference in the article that shunt-connected p.f.c. capacitors will reduce the third harmonic content. This, no doubt, is a misinterpretation of the paragraph concerning capacitor failures and the resulting current increases caused by low power factor and possible unbalancing of phases.

Shunt-connected capacitors correct only the fundamental portion of the current, therefore the resultant neutral current will be the uncorrected value, plus the third harmonic content of the capacitor currents (added vectorially). This fact is shown by Mr Lloyd's test results using switch-start gear in which the anomalous comparison between test numbers three and four and the discrepancy between test numbers four and five may be caused by one or more of those many variables that occur in measurements of this type.

I am sure that the use of low power factor control gear, as Mr Lloyd suggests, will be uneconomic, requiring larger distribution conductors and switchgear, apart from the undesirable effects upon transmission and generation equipment. Surely it is more desirable to minimise the third harmonic content by using semi-resonant switchless start types of control gear.

It is indeed interesting to read that the Standards Association of Australia has specified the maximum harmonic content for fluorescent control gear, but I was not aware that a similar specification had been adopted by the IEC, although I believe such a clause is under consideration.

If the ERA would investigate this problem and make recommendations in reference to limiting the extent of the third harmonic content, this would be appreciated by installers and users of such equipment, since there is no doubt that large fluorescent lighting installations do produce undesirable conditions, especially on main distribution networks where half-size neutrals are used.

J. Flood, ASSOCIATE I.E.E.,
LONDON, W.4.

* * *

MR LLOYD'S account of Australian experience of this problem and of the numerical results of the tests which were carried out is full of interest.

It seems, however, that he reads an inference into Mr Flood's article which its author cannot have intended.

The essential point, surely, is that in conventional switchless-start circuits the placing of the power factor capacitor across the mains tends to encourage the growth of troublesome harmonics. In the semi-resonant circuit, on the other hand, it is connected in such a way that it opposes these higher frequency currents.

J. Boud,
RICHMOND, SURREY.

Earthing in S.W. Africa

IT may be of interest to your readers to know how the Windhoek (South West Africa) Municipality Electricity Department allows earthing of installations. In this town the protective multiple earthing of the neutral is used, but on all new installations now the Electricity Department insist that an earth wire must be run direct from the earth bar on the main switchboard to the water meter. (Each house has its own water meter, which in most cases is situated in the front garden, adjacent to the footpath in the street.) The water meter is bonded across. It is the intention of the Electricity Department, at a later date, to run a main earth wire along the streets so that the earth wire from the installation is connected to this main earth wire. On the main board, all the earth wires are connected to the supply neutral. Also, a direct earth wire is run to all socket-outlets, cookers, water heaters, etc. This seems to me a much better idea than relying on the conduit for the e.c.c., and also all conduits are bonded at the main board. The regulations state that all metal sinks, metal roofs, waste pipes and down pipes must be earthed, and also hot and cold water pipes.

E.L.C.B's are used in areas where a resistance of over 5 ohms is recorded from the supply neutral to the water pipe or earth electrode. These e.l.c.b's have one side of the trip coil connected to the main earth bar, which is also connected to the supply neutral, the other side of the trip coil is connected to an earth electrode in the ground.

It was the practice at one time in this town on the installations to use the neutral at the socket-outlet, cooker, water heater, etc., as the earth; but this was not good practice.

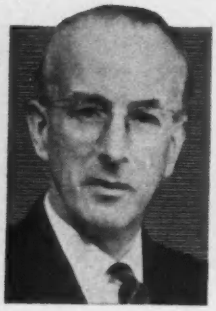
The metering equipment on the houses in most installations is situated outside, in cupboards on the front verandah, at the side of the house, or at the back, so there is no difficulty for the meter reader to read the meter. Another interesting point is that on all new installations m.c.b's are always used.

A. Dearden,
WINDHOEK, S.W. AFRICA.

Personalities *in the industry*

Mr F. Richardson

Mr E. B. Angood



Mr J. Anderson

Mr W. J. Forster

Mr J. Bennett

Now in Britain on an extensive tour of investigation for the Commission is **Mr N. T. Jewell,** director of engineering to the State Electricity Commission of Victoria, Australia. He is to confer with contracting firms and consultants associated with the Commission. This week he has been visiting works in the north of England and returns to London on 22 June, but he remains in this country until the end of July, when he will proceed to the USA.

Chief engineer to "Diamond H" Switches Ltd. since 1946, **Mr G. H. F. Walton,** B.SC.(ENG.), A.M.I.E.E., is joining the Plessey Co. Ltd. as chief engineer attached to the Component Development Group at Titchfield, near Fareham, as from 1 July. Before joining "Diamond H," Mr Walton served with Simms Motor Units Ltd. for eight years.

District manager at Exeter to the South Western Electricity Board since July, 1958, **Mr F. Richardson,** ASSOCIATE I.E.E., has now been appointed district manager at Bristol, where he succeeds **Mr A. G. Milne,** M.I.E.E., M.I.MECH.E., A.M.B.I.M., who has become chief engineer of the London Electricity Board (*ESH, pages 100, 102). Mr Richardson spent his early years with W. T. Henley's Telegraph Works Co. Ltd., and in 1937 was promoted to be their engineer in charge of contracts in the Midlands and South Wales areas. In 1942 he was appointed to be their contracts manager in Northern Ireland, where he worked for seven years. Mr Richardson joined the South Western Electricity Board in 1949 and was appointed area construction engineer with special responsibility for setting up the Board's Central Construction Department at Taunton. At the same time he organised the Linesmen's Training School there, and initiated original research into the prevention of decay and preservation of wooden power poles. Two years later he was promoted to be assistant chief engineer (construction) and led a team of experts who standardised the Board's overhead line construction and substations. In 1953 he was appointed assistant chief commercial officer (supply) at the Board's headquarters in Bristol.

Previously managing director of Morgan Components Ltd., one of the Morgan Crucible Co. group, **Mr E. B. Angood,** A.M.I.E.E., A.M.I.MECH.E., has joined Ultra Electronics Ltd. as works manager. The latter company have also appointed **Mr R. G. Mammatt,** previously with Cosmocord Ltd., as a new projects officer in the Control and Instrumentation Division.

President of the Association of Mining Electrical and Mechanical Engineers for the ensuing year is **Mr J. Anderson,** O.B.E., J.P., M.B.I.M., chairman and managing director of Anderson, Boyes and Co. Ltd., with whom he has served throughout his career. He is a past president and executive committee member of the Council of Underground Machinery Manufacturers, and vice-chairman of the Federation of Associations of Colliery Equipment Manufacturers, in addition to serving on a number of other committees relating to the mining industry.

Mr J. Eager, A.C.I.S., secretary of Griffiths Bros. and Co. London Ltd., has been appointed a director. He has just completed 30 years' service with the company, and now becomes director and secretary.

Elected president of the Association of Managerial Electrical Executive at the annual general meeting at Eastbourne this week is **Mr W. J. Forster,** M.I.E.E., A.M.I.MECH.E., sub-area commercial officer, No. 1 sub-area of the Merseyside and North Wales Electricity Board. He joined the AMEE in 1946 and, except for one year, has been a member of the National Executive since 1952. He has served in the supply industry since 1922, following an engineering apprenticeship with the Shelton Iron, Steel and Coal Co. He became district engineer with the Hackney undertaking in 1927, and after subsequently serving with Stoke Newington, Rawtenstall, Heston and Isleworth, and Walthamstow Corporations, was appointed engineer and manager at Wallasey in 1946. He has held his present post since 1948.

As from 1 July next, **Mr H. H. Mullens,** B.SC., M.I.E.E., becomes executive chairman of A. Reyrolle and Co. Ltd., and consequently will relinquish the position of managing director. **Mr J. Bennett,** M.I.E.E., who has been general manager for the past two years will, from the same date, become the managing director. Mr Mullens joined the company in 1954 as managing director and four years later was appointed chairman. Earlier, he had been chairman of the North Eastern Electricity Board for six years. A native of London, Mr Mullens was educated at Merchant Taylors' School, from which he joined the Royal Naval Air Service and subsequently became a pilot officer in the RAF until demobilisation in 1919. Technical training at the Gateshead works of Clarke, Chapman and Co. Ltd. followed and for three years from 1921 to 1924 he was at Armstrong (now Kings) College, Newcastle upon Tyne. He joined the North Eastern Electric Supply Co. Ltd., and after occupying various positions of responsibility in the Lighting and Heating and also Power and Construction Departments became a deputy general manager of the company, whose territory at that time covered 5,600 square miles. He held that posi-

**Denotes revision to the "Electricity Supply Handbook, 1961."*

tion until 1948. Also a Londoner, Mr Bennett was educated at Brockley School, and at Rutherford Technical College, Newcastle upon Tyne. He joined A. Reyrolle and Co. in 1920 as a technical apprentice and was transferred to the Sales Department on completion of his apprenticeship. When this department was reorganised he was appointed assistant contracts manager, subsequently becoming manager in 1944. Co-opted to the board in 1953, he became general manager of the company six years later. A past-president of the North East Electric Club, he is a member of the Council of the Association of Short Circuit Testing Authorities, and represents the company on a number of other committees.

British Insulated Callender's Cables Ltd. announce that **Mr C. S. F. Lane** has been appointed regional manager for Canada and the United States in addition to his present territories of Australia and New Zealand. Mr Lane has already taken over these new responsibilities within the BICC Overseas Organisation in London. His appointment as regional manager for Australia and New Zealand was announced in February, 1959.

Until recently Stirling area engineer to the South of Scotland Electricity Board, **Mr H. A. Carson,** M.I.E.E., F.R.S.A., M.INST.F., was the recipient of a presentation by **Mr J. G. Curtis,** area manager, on behalf of colleagues on his retirement recently. A presentation was also made to **Mr F. Smedley,** M.B.E., district engineer at Bathgate, who has also retired (*ESH, page 170). Mr Carson became area engineer, Stirling area, in 1955, after being sub-area engineer with the SE Scotland Board from 1948.

Newly elected president of the Electrical Contractors' Association of Scotland, **Mr Alec Robertson,** principal of the Glasgow firm of A. Robertson and Co. started in business on his own account in 1921 and has taken an active part in Association affairs for many years. Prominent in electrical circles in the West of Scotland, Mr Robertson was educated at Allan Glens School and at the Royal Technical College, Glasgow. His early training was obtained with Woodward and Co. and latterly with D. McLucas and Co. for whom he was appointed manager before starting his own business. A member of the Glasgow Territorial Association and president of the Glasgow and West of Scotland Royal Engineer's Association, Mr Robertson saw active service in France during the last war and was later appointed project engineer for the provision of underground accommodation on the South Coast for Combined Operations including the installation of generating plant, ventilation plant, gas filtration and all other services. He holds the rank of Lt/Col and the Emergency Reserve Decoration with three Bars.

Mr J. H. Williams has resigned from the board of Lloyd's Packing Warehouses (Holdings), and from Regentone Products Ltd. and its subsidiaries.

Retiring after nearly 45 years' service in the industry, **Mr H. Waite,** second assistant engineer, Commercial Section, of No. 2 sub-area of the Yorkshire Electricity Board, was the recipient of a presentation by **Mr C. Booth,** sub-area manager, recently. Mr Waite has been secretary of the Huddersfield Engineering Society for 25 years.

Previously works manager to the Brush Electrical Engineering Co., Loughborough, **Mr E. Mason** has joined Rank Precision Industries Ltd. as general manager of the factory of the Cine and Photographic Division, Mitcheldean, Glos.

Mr J. Winfield has joined the sales staff of Alfred Ellison Ltd., and is now responsible for the sales and consultative service for grey iron castings in the Midlands. He was previously sales manager of Idoson Motor Cylinder Co. Ltd. subsequent to serving Qualcast (Wolverhampton) Ltd.

A new appointment in the AEI Traction Division is that of **Mr J. H. Elvin** as assistant superintendent, Traction Manufacturing Department. Educated at Salford Royal Technical College, he served his apprenticeship with Metropolitan-Vickers Electrical Co. Ltd. from 1924 to 1930. He is an ex-chairman of the Metropolitan-Vickers Production Association.

Mr J. Hayward has been appointed public relations officer to the General Electric Co. Ltd.

Mr H. B. McKinty, M.C., B.L., has retired from the position of chairman of James Kilpatrick and Son Ltd., but remains a director of the company. His successor as chairman is **Sir Andrew M. MacTaggart.** In addition, **Mr Hugh G. Balfour** has become deputy chairman of the company, and **Mr Thomas A. Scott,** a director, in place of **Mr W. R. Bruce,** M.I.E.E., who recently retired.

Mr A. C. Ball, London branch manager, **Mr E. A. Ellerton,** commercial manager, and **Mr A. M. Taylor,** secretary, have been appointed to the board of Foster Electrical Supplies, a company in the Metal Industries Group. Mr Ball has been with the company since 1923 and Mr Ellerton since 1930. Mr Taylor has been secretary of Foster Electrical Supplies since 1956, and is also secretary of Foster Transformers.

Assistant chief project engineer in the Southern Project Group, CEGB, since 1958, **Mr W. B. Shannon,** M.I.C.E., M.I.MECH.E., M.I.E.E., FEL.A.S.M.E., has retired from that post. His successor is **Mr B. C. Pyle,** M.I.E.E., who previously held a similar post with the Northern Project Group. In turn, the latter position is being taken over by **Mr D. A. Pask,** A.C.G.I., B.SC.(ENG.), A.M.I.MECH.E., A.M.I.E.E., M.INST.F., MEM.A.I.E.E., who has been a project engineer with the Southern Project Group (*ESH, pages 51, 52).

South Eastern Region

Under the new regional reorganisation of the CEGB, the South Eastern Region have now appointed two assistant regional directors: **Mr L. W. Stretton,** M.I.E.E. (North Thames Division), and **Mr W. H. Dunkley,** B.SC., M.I.MECH.E., M.I.E.E. (South Thames Division), with **Mr W. T. Bamford,** B.SC., A.M.I.C.E., A.M.I.MECH.E., as senior executive officer (Generation House). Pending the appointment of a regional personnel officer, **Mr H. F. Chastney** is acting assistant regional secretary (personnel) with two acting personnel officers, **Mr D. R. Boxall** (North Thames Division), and **Mr E. P. L. Greig** (South Thames Division). In addition, there are two administrative officers, **Mr H. G. Penniket** (North Thames), and **Mr E. J. H. Austen** (South Thames). Outline proposals for Electrical and Generation Operation Departments of the two new Divisions are being considered (*ESH, pages 54 to 58).

Mr C. S. F. Lane

Mr A. Robertson

Mr J. Winfield

Prior to joining the Southern Project Group, Mr Shannon was chief generation engineer (construction) to the London Division from September, 1954, following over six years in a similar capacity with the South Eastern Division. He has been directly concerned with numerous projects, including over 20 power station construction sites, many of these from their inception, in London and the south eastern part of the country. He joined the London Electric Supply Corporation and the London Power Co. in 1926, was appointed assistant progress and inspection engineer in 1934. Employed in that capacity until 1948 he was particularly concerned, as one of Sir Leonard Pearce's team of engineers, on Battersea and Deptford power stations from the projection stages onwards. Before going to the Northern Project Group in January, 1958, Mr Pyle had been with the Southern Division of the CEA since 1948, for the last four years as chief generation engineer (construction). Initially, he was personal assistant to the divisional controller and a year afterwards became senior assistant engineer (construction). Mr Pask, who was group project engineer, Nuclear Power Branch of the CEGB, before joining the Southern Project Group in 1958, had earlier been deputy resident engineer at the Calder Hall power station of the UKAEA, to which he was seconded from the CEA. Prior to that he was resident engineer at East Yelland power station.

Mr D. Major, B.A., B.SC., has been appointed assistant chief engineer of the X-ray department of Instrumentation Division, Associated Electrical Industries Ltd. He joined Metropolitan-Vickers Electrical Co. Ltd. in 1948 as a college apprentice and, after his apprenticeship, worked first on accelerators in the High Voltage Laboratory of the Research Department, then in the Linear Accelerator Section, Scientific Apparatus Engineering Department, in 1958.

At present Permanent Secretary to the Ministry of Defence, **Sir Edward Playfair,** K.C.B., is to become chairman of International Computers and Tabulators Ltd., from 1 Aug.

Mr W. Keen, melting technical adviser to Jessop-Saville Ltd., has been elected president of the Electric Steel Makers' Guild of Gt. Britain.

At present senior lecturer in the Department of Electrical Engineering at Birmingham University, **Mr J. T. Allanson,** M.SC., A.M.I.E.E., has been appointed second professor in that department. Mr Allanson, who takes up the newly established chair on 1 Oct., was educated at Bury Grammar School and Manchester University, where he became Ministry of Supply research engineer in 1942. From 1944 he held various posts in industry until 1949, when he joined Birmingham University as lecturer, and was promoted to senior lecturer four years later. In addition, the University has appointed **Mr D. C. Cooper,** M.SC., to be lecturer in the Department of Electrical Engineering.

Chief electrical engineer for the West Ayr area, National Coal Board, **Mr J. McOwat** has retired. His successor is **Mr W. Erskine.** Mr McOwat, a past-national vice-president of the Association of Mining Electrical and Mechanical Engineers, was presented with a radiogram by **Mr R. D. Glass,** area general manager, on behalf of friends and colleagues.

Mr P. J. Hobbs, DIP.M.I.E.S., has been appointed technical sales engineer in Yorkshire and surrounding areas for Courtney, Pope (Electrical) Ltd. He will be operating from the Leeds office.

Six new commercial appointments are announced by Philips Electrical Ltd.: **Mr A. L. Sutherland,** director and commercial manager of radio, TV and ELA group, is to be director and general sales manager from 1 July; **Mr H. M. Thorne,** personal assistant to Mr G. Hofman, the managing director, is to be marketing manager from the same date; **Mr J. Jordan,** manager, NW Region, becomes manager of Cossor Radio and TV Ltd.; **Mr J. Josey,** manager of Liverpool branch becomes regional manager, NW Region; **Mr J. D. Callaway,** manager of Cardiff branch is now assistant regional manager, SW Region (for the time being Mr Callaway will continue to manage Cardiff branch); and **Mr G. T. Jones** becomes Liverpool branch manager. At the moment it is not intended to appoint a successor to Mr Sutherland as commercial manager of the Radio, TV and ELA group. Mr Sutherland will, however, continue representation of the company on industry associations.

Mr E. Heys, A.M.I.E.E., has been appointed manager, Electronic Sales Department (Manchester) of the AEI Electronic Apparatus Division. When the latter division was formed in 1959, Mr Heys became assistant manager, Computer Sales Department, and acting assistant manager, Servo Sales Department, positions he held until his present appointment.

Formerly works manager at the AEI cable plant at Lydbrook, Glos, **Mr A. H. H. Young,** B.SC.(ENG.), A.M.I.E.E., has joined Crompton Parkinson Ltd. as general manager at the Derby works. He will be responsible there to Mr R. F. D. Milner who has relinquished his position as general manager while retaining his responsibility as managing director of Derby Cables Ltd. Mr Young's association with the cable industry began in 1936 with Henley's W.T. Telegraph Works and since the war he has held senior appointments with the Cable Manufacturers' Association and the Liverpool Electric Cable Co. Ltd., now part of the AEI group. He has also served on many C.M.A. and B.S.I. committees.

Associated Electrical Industries (Manchester) Ltd. have appointed **Mr R. Crummack,** B.SC., as superintendent (process and rate) and **Mr R. G. Nicholas,** GRAD. I.MECH.E., as superintendent (production engineering services), both in the Manufacturing Services Department.

To mark the commencement of the silver jubilee year of Metway Electrical Industries Ltd., changes in the board of directors are announced. **Mr Robert F. Still,** who has been a director since 1946, now becomes joint managing director with **Mr D. G. E. Barrie** (founder of the company) who remains chairman and joint managing director. Four heads of departments have been rewarded for their service to the company by being appointed directors. They are: **Mr S. V. Funnell,** works (19 years' service); **Mr L. Brulais,** sales (15 years' service); **Miss M. Crock,** export (15 years' service); and **Mr W. T. Tomsett,** accounts (14 years' service).

The Personnel Services of AEI (Manchester) Ltd. have been rearranged. **Mr D. J. Crowther** continuing as manager, Group Personnel Services. As already announced, Mr R. F. Marshall has been appointed central education manager of AEI Ltd. and has moved to 33 Grosvenor Pl, S.W.1. The Education Department becomes part of the Group Personnel Services. Appointments within the Group Personnel Services are: **Mr J. S. Butterworth,** M.I.P.M., labour manager; **Mr H. Walker,** M.A., M.I.P.M., staff manager; **Mr B. Dawkins,** B.SC.(ENG.), A.M.I.E.E., A.M.I.MECH.E., education manager; and **Mr R. F. Jones,** B.A., chief information officer. **Miss M. Shingler** continues as chief supervisor of women and **Miss M. Whitehurst** as chief supervisor of canteens.

OBITUARY

Mr F. H. Houghton, A.M.I.E.E., industrial cable sales manager with Crompton Parkinson Ltd. since 1945, died on 8 June. He joined the company in 1936 as a cable salesman, and became manager of the Portsmouth branch in 1939. After three years there he joined the Ministry of Supply, Cable Planning Authority, where he remained until the end of the war.

Mr H. Watson, formerly manager of the Sutton Coldfield and North East District of the Midlands Electricity Board, has died, aged 67.

In The Birthday Honours List

A NUMBER of prominent figures in the electrical industry appear in the Queen's Birthday Honours List announced last week-end. Among the new barons are: **Sir Brian Robertson,** until recently chairman of the British Transport Commission; and **Mr Alfred Robens,** the new chairman of the National Coal Board, who was also secretary of the Ministry of Fuel and Power from 1947 to 1951.

A Baronetcy has been awarded to **Sir John Maxwell Erskine,** G.B.E., J.P., D.L., deputy chairman of the North of Scotland Hydro-Electric Board.

Recipients of Knighthoods include: **Mr W. K. G. Allen,** M.I.MAR.E., A.M.I.N.A., chairman and managing director of W. H. Allen Sons and Co. Ltd., and chairman of the Council of BEAMA; **Mr S. Barratt,** chairman, Albright and Wilson Ltd.; and **Mr A. G. Clark,** chairman and managing director of the Plessey Co. Ltd.

Sir Ivan Stedeford, K.B.E., chairman and managing director of Tube Investments Ltd., who is also chairman of the Advisory Group on the British Transport Commission, is awarded the G.B.E.

C.B.E.

There is an unusually large number of recipients of the C.B.E., among whom are: **Mr C. F. Barnard,** executive vice-chairman, Mirrlees, Bickerton and Day Ltd.; **Mr W. A. Fairhurst,** senior partner, F. A. MacDonald and Partners, consulting engineers; **Mr F. G. Gillard,** O.B.E., controller, West Region, BBC; **Mr D. H. Kendon,** B.SC.(ENG.), M.I.E.E., M.I.MECH.E., who has been chairman of the Merseyside and North Wales Electricity Board since 1954, after being deputy chairman of the Midlands Electricity Board for the previous six years; **Mr A. F. Lampitt,** J.P., F.C.A., COMP.I.E.E., managing director of Telephone Cables Ltd.; **Mr E. Norton,** research director of Yarrow and Co. Ltd.; **Mr F. W. Page,** director and chief executive, Aircraft Division, English Electric Aviation Ltd.; **Dr W. H. Penley,** B.ENG., PH.D., A.M.I.E.E., deputy chief scientific officer, Royal Radar Establishment, Ministry of Aviation; **Dr N. H. Searby,** PH.D., B.SC., M.I.E.E., manager, Guided Weapons Dept., Ferranti Ltd.; **Mr G. A. Whipple,** M.A., M.I.E.E., chairman and managing director, Hilger and Watts Ltd.; and **Prof F. C. Williams,** O.B.E., D.PHIL., D.SC., M.I.E.E., F.I.R.E., F.R.S., Professor of Electrical Engineering, University of Manchester.

O.B.E.

Among those awarded the O.B.E. are: **Mr A. E. G. Carey,** A.M.I.E.E., electrical engineer, Admiralty; **Mr A. Crisswell,** deputy regional director, GPO; **Mr E. C. French,** head of buying, BBC; **Mr J. L. Phillips,** head of Reactor Division, Dounreay Experimental Reactor Establishment, UKAEA; **Mr A. T. Stokoe,** chief, O and M Dept., Cable and Wireless Ltd.; and **Mr W. H. Twells,** principal, Ministry of Power.

M.B.E.

Recipients of the M.B.E. include: **Mr W. E. Bell,** superintendent, Applied Electronics Laboratory, GEC, Portsmouth; **Mr F. N. Charles,** A.M.I.E.E., area engineer, GPO, Brighton; **Mr H. F. Collard,** chief draughtsman, E. N. Bray Ltd.; **Miss L. M. Conway,** secretary, National Joint Industrial Council, for the heating, ventilating and domestic engineering industry; **Mr M. Cullen,** shop superintendent, James Howden and Co. Ltd.; **Mr L. Douglass,** A.C.G.I., A.M.I.C.E., M.I.MECH.E., M.I.E.E., who recently retired from the position of secretary and engineer to the Isle of Man Electricity Board; **Mr E. A. Emery,** A.M.I.E.E., executive engineer, London Telecommunications Region, GPO; **Mr T. G. C. Harrop,** M.I.E.E., electrical manager, J. I. Thorneycroft and Co. Ltd.; **Mr R. G. Hawkins,** chairman and managing director, Redcliffe Radio and Engineering Co., Bristol; **Mr J. Kaiser,** manager, Outside Power Plant Erection Dept., Richardsons, Westgarth (Hartlepool) Ltd.; **Mr D. Kitcher,** research and testing manager, Santon Ltd.; **Mr J. V. McIntosh,** works manager, Fluorescent Lamp Dept., Thorn Electrical Industries Ltd.; **Mr J. D. Matthews,** senior executive officer, Ministry of Power; **Mr J. S. Oliver,** ASSOCIATE I.E.E., generation engineer, North of Scotland Hydro-Electric Board; **Mr J. J. Rowland,** head of Marine Dept., Electrical Apparatus Co. Ltd.; and **Mr L. H. Rowley,** senior station radio officer, Admiralty.

B.E.M.

Those awarded the B.E.M. include: **Mr J. Anderson,** foreman jointer, South of Scotland Electricity Board, Edinburgh; **Mr T. Beeley,** meter tester, No. 3 subarea, Yorkshire Electricity Board; **Mr R. F. Griffin,** general foreman, Peterborough refrigerator factory, AEI-Hotpoint Ltd.; **Mr H. Lambert,** senior foreman, Hammersmith district, London Electricity Board; **Mr F. C. Rawlings,** yard foreman, Cardiff power station, South Wales Division, CEGB; **Mr H. E. Richards,** model shop foreman, Decca Radar Ltd., Tolworth; and **Mr C. W. Sykes,** second assistant engineer (construction) Eastern Electricity Board, St. Neots.

Overseas

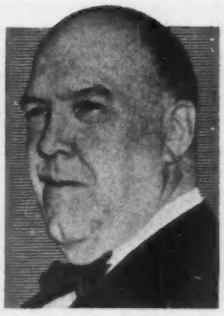
Turning overseas, the Imperial Service Order has been awarded to **Mr J. H. Griffiths,** M.I.E.E., chief electrical and mechanical engineer, Tanganyika; and a Knighthood is bestowed upon **Mr C. J. A. Moses,** C.B.E., general manager of the Australian Broadcasting Commission.

The O.B.E. goes to **Mr J. A. Gagon,** deputy general manager, Singapore Telephone Board; **Mr C. McCarron,** president, Local Government Electricity Supply Association, State of New South Wales; and **Mr G. Whitmore,** A.M.I.E.E., formerly commercial engineer, Central Electricity Board, Federation of Malaya.

In addition, the M.B.E. is awarded to **Mr N. M. Speer,** general manager of the Auckland Electric Power Board, for services to the electrical industry; and to **Mr A. G. Smith,** chief superintendent, Electricity Dept., Sierra Leone.

Sir John Erskine (Bt.)

Mr W. K. G. Allen (Kt.)



Mr A. G. Clark (Kt.)

Mr D. H. Kendon (C.B.E.)

Mr J. V. McIntosh (M.B.E.)

NOTES ON WIRING

BY MECOHM

THIS week I received a brochure which informed me that the original manufacturers of mineral-insulated, copper-sheathed cable were this year celebrating their silver jubilee. I therefore hastened to pass on my congratulations and to hear of their latest technical ideas and information. I feel that it is most important to keep up to date on the developments in this specialised field of cable work.

During my talk with the specialists on m.i.c.s. cable it came to light that many operatives maintain that the seal on the end of the cable should rest in the conduit gland, which is fitted to the wall of the box or fuseboard, etc. This is not really necessary, and the sheath of the cable, with the pot seal on the end, can be taken as far into the box or fuseboard as deemed necessary and safe. The gland can still be fitted into position on the wall of the box and, when tightened up, will grip the cable securely. The need for long tails of cable is eliminated.

It is not always convenient to avoid long tails. Where they are required there are available extension tail joints. These consist of a tinned connector, into which the m.i.c.s. conductor and a flexible stranded conductor are joined, the joint being covered with a neoprene coupler. Where such flexible tails are used, a reference needs to be made to the IEE Tables Nos. 12 and 23, for the ratings of plastics- or rubber-insulated conductors are quite different from the rating of an m.i.c.s. conductor. This is a point worth watching.

The manufacturers have now a medium temperature compound on sale and this covers the range of −20°C to +150°C. Also on sale is a new "pack" of 12 screw-on pot seals, two sticks of plastics compound and six double-ended sub-assemblies of sleeving, caps and wedges. A most useful addition to the operative's tool kit.

I must just add, in print, my good wishes to this firm, and my thanks for their assistance in many matters.

New Twin 13 A Socket

I was shown a new twin socket the other day and all its features were described. This socket comes in two grades, a standard type and a heavy duty type, the latter having mouldings of materials specially chosen for high strength and resistance to blows, etc. Also available is a combined insulated pattress and block for use with this socket. Used together, a single gang flush socket can be converted to a twin surface unit. This is, of course, only one of its uses, and the descriptive leaflet its makers have issued shows ten different uses. The pattress-box is also suitable for use with m.i.c.s. cables, and four knockouts are provided to accept twin 0·003 m.i.c.s. cable fitted with "G" size cold screw-on pots with earthing tail. Also provided are 12 surface and four rear knockouts, each capable of accepting 7/·029 t.r.s. or p.v.c. twin and earth cable. There is also a $\frac{3}{4}$ in. diameter knockout in the rear.

The socket itself is designed to fit either plaster depth or deep standard boxes, and the terminals, each capable of receiving three 7/·029 cables. The approximate front projection is $\frac{7}{16}$ in. and the box depth is $1\frac{1}{4}$ in.

Some time ago I described a conversion set similar to this one which I considered excellent. Later, I was shown another which had the pattress-box made to a depth of $1\frac{1}{4}$ in. The latter was a sound engineering job, but gave me a little bit of trouble when trying it out because of that extra depth. I found that the length of tails left in the flush box were not long enough to allow easy connection. I must add that the socket used with the deeper pattress had a flat faceplate, not deep as is normal with a socket designed to suit plaster-depth boxes. When I used this deep box arrangement in a kitchen where tiles were fitted I found it quite impossible to connect up the socket because the tails were too short, even though these tails were of the usual length for normal connections to a flush socket. This is a point worth bearing in mind if such conversions are contemplated. When all is said and done, there is really little room available for cable stowage in the standard flush socket box. This is one of the prices we pay for neatness and smallness in the modern sockets.

Metric System?

We all know of the discussions and decisions regarding the proposed changes in the monetary system of this country. This will come hard to many if the plans materialise, and the people who seem to favour it most are the schoolchildren! I saw something the other day which made me wonder just how far the metric system would affect we engineers. A contractor friend of mine showed me a drawing sent with a specification prepared by a Government department and asked me if I noticed anything unusual about it. I looked over the drawing and I was just about to answer in the negative when I noticed the scale was "$\frac{1}{1}$ in.=1 ft." My friend then asked me if I could lend him a $\frac{1}{1}$ in. scale rule and I had to admit that I couldn't. Later on, in my office, I looked through my sets of scales, but could not find the right one.

No doubt they may be made, but the normal scale carried by engineers certainly doesn't have a $\frac{1}{1}$ in. side. So, watch out, *always* look at the scale before starting to measure up the job!

ECA Conference

Some thought-provoking points emerged from the paper on the future of contracting presented at the ECA Conference. It is always interesting to hear of ideas for the future. "Standardisation" has been mentioned by many engineers, but I cannot see it becoming complete because of competition, which is always inclined to make designers produce something "non-standard." However, I agree that the use of the 13 A outlet is increasing and, if planned correctly, should become standard throughout the country —at least in domestic circles.

Another future idea suggested in the paper was the introduction of an armoured flexible cable system with purpose-made fittings for use in wall cavities, building voids, etc. This must come about, because of the substantial increase in the manufacture and use of patent partitions. I think it must be some six or seven years since I first commented on the use of such wall units and I feel that this matter needs another investigation. I am constantly being told by contractors of the troubles experienced when such units are used.

Fluorescent Lighting for Cold Stores

PROBLEMS OF OPERATION AT SUB-ZERO TEMPERATURES

by D. D. Holloway*

THE use of fluorescent lamps in conditions where ambient temperatures depart substantially from those encountered in office and factory (20°C to 25°C) has given rise to difficulties both in reliable starting and efficient operation.

This has been a considerable drawback in the application of fluorescent lighting to cold storage and deep freeze installations, where its high efficiency offers the normal economic saving plus reductions in the cost of compressor operation resulting from the lower lighting load or heat input for the same level of illumination by tungsten filament lamps.

Fundamentally, the energy balance in a fluorescent lamp is inherently well suited to large volume refrigerated areas. It can be seen from Fig. 1 that, with a hypothetical fluorescent lamp of 100 W input, the conversion results in some 22 W radiated as light and about 30 W of radiant heat emission. The balance, 48 W, is distributed in the form of convected and conducted heat, including that from the electrode areas which are usually shrouded, which does not directly affect the stored products. Taking into account the fact that radiated light energy is also eventually absorbed as heat, the 100 W lamp radiates a total of about 52 W capable of directly raising the temperature of the stored products.

For comparison purposes, an incandescent lamp of 100 W input radiates some 90 W total.

Combining the factors of high efficiency in terms of light generation, and the specific differences in the energy balance between tungsten filament and fluorescent lamps, the former yields about five times as much radiant energy and requires three to four times as much power as the latter for the same illumination.

In addition, the diffuse light distribution from large area sources is an advantage in the relatively closely stacked areas of a refrigerated store, ensuring that loading areas, batch labels, etc., can accurately be distinguished in spite of obstructions offered by surrounding stacks of produce.

The above factors accepted, it is apparent that the fluorescent lamp is close to being the best available light source for refrigerated cells, providing that the difficulties normally associated with operation on standard 240 V 50 c/s supplies at ambient temperatures of −25°C can be eliminated.

There is no doubt that part of the difficulty of operating fluorescent lamps at very low temperatures is due to the relatively meagre data on their behaviour under these conditions. As a consequence, the real limits of operation, particularly in regard to ignition, are largely undefined.

The problems of operation concern, specifically, reliable ignition and reasonably efficient operation in terms of light output, both of which are closely associated with the mechanism of the discharge. An elaboration of these functions is given here, together with the results of test data indicating a relatively simple approach to problems of operation in refrigerated stores with standard components.

*Lighting Div., Philips Electrical Ltd.

Table I

Minimum required voltage† at lamp terminals to strike switch start fluorescent lamps at a given ambient temperature within 60 resp. 10 sec. for 90% of the tested batch.

		Ignition time; up to 60 seconds						Ignition time; up to 10 seconds					
		−20°C	−15°C	−10°C	−5°C	0°C	5°C	10°C	20°C	30°C	40°C	50°C	60°C
with glow starter (type S10) (single lamp circuit)	MCF/U 20 W ind.	207	200	195	190	187	191	188	184	182	180	180	180
	" cap.	207	200	195	190	187	191	188	184	182	180	180	180
	MCF/U 40 W ind.	208	198	193	187	183	186	183	180	180	180	180	180
	" cap.	—	—	—	195	187	191	187	183	180	180	180	180
	MCF/U 80 W ind.	215	205	199	194	190	190	187	184	182	180	180	180
	" cap.	223	211	203	196	191	190	187	184	182	180	180	180
	MCF/U 15 W ind. (1" diameter)	—	195	192	190	188	190	188	187	185	184	183	183
	MCF/U 22 W ind. (circular)	207	200	195	191	189	189	187	185	185	185	195	185
	" cap.	223	210	203	197	193	193	190	186	185	185	185	185
	MCF/U 32 W ind. (circular)	215	205	200	194	190	190	186	184	183	183	183	183
	" cap.	—	215	205	198	193	193	190	185	184	184	184	184
	MCF/U 40 W ind. (circular)	—	223	213	203	195	197	191	185	182	180	180	180
	" cap.	—	—	—	230	210	213	203	190	184	180	180	180

† This voltage is the mains voltage for chokes and capacitive ballasts without step-up of the mains voltage. For low-voltage gear it is the secondary voltage produced by the ballasts.

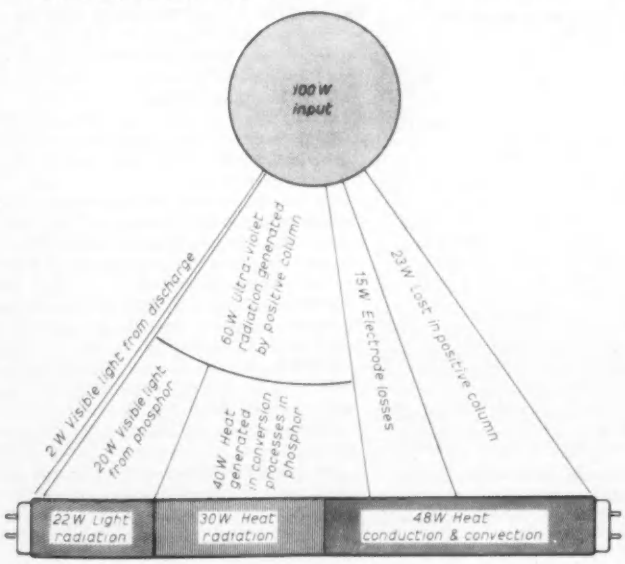

100 W input
2 W Visible light from discharge
20 W Visible light from phosphor
60 W Ultra-violet radiation generated by positive column
40 W Heat generated in conversion processes in phosphor
15 W Electrode losses
23 W Lost in positive column
22 W Light radiation
30 W Heat radiation
48 W Heat conduction & convection

Fig. 1. Breakdown of energy dissipation in a hypothetical 100 W fluorescent lamp

Ignition Conditions

The fluorescent lamp normally is filled to a pressure of 2 mm. to 5 mm. mercury with the rare gas argon, in addition to a small quantity of mercury vapour present at normal ambient temperatures.

To initiate the discharge, it is necessary first to ionise the gas filling. This is accomplished by preheating the oxide-coated electrodes of the lamp, so releasing a stream of electrons. These electrons are accelerated by the voltage applied across the lamp and cause ionisation of the argon gas filling, either directly or by multiple excitation.

The effect of external cooling on the pressure of the gas can be seen from Fig. 2. At very low pressure there are few gas atoms present; therefore, chances

of ionisation occurring are remote and the breakdown value of the gas is high. Conversely, at high temperatures the mean free path of the charged particle is low and the kinetic energy imparted to it by the electric field is insufficient to bring about significant ionisation of the gas. Consequently, breakdown voltage rises with increasing pressure.

In addition to the above effects, it is known that, at a given temperature, the ignition voltage is lower with a mixture of argon and mercury vapour. This is because argon is capable of ionising mercury atoms when the former is in the so-called meta-stable state. At ambient temperatures of 20°C to 25°C, mercury has a vapour pressure of about 10^{-3} mm. As the ambient temperature drops, the mercury vapour pressure also falls and the breakdown voltage of the mixture approaches that of pure argon.

Glow-switch Operation

The most common method of initiating the discharge is by means of a "glow," or voltage operated, starter switch. This is connected across the lamp in series with both lamp electrode heaters and the ballast during the starting period. The influence of gradual lowering of ambient temperature is indicated in Table 1.

It will be seen that in ambient temperatures above 5°C at least 95% of the lamps tested were capable of reliable ignition within 10 sec, this being an acceptable delay for the mode of operation. Below 5°C the striking time gradually increases, tends to be erratic, and the delay in initiating the arc may extend to 60 sec, even with higher applied voltages. During this delay period, the glow-switch continually closes and opens, each cycle first heating the lamp electrodes and then inducing a high voltage pulse across the lamp. As the life of a fluorescent lamp is, to some extent, dependent upon the number of such starting cycles to which it is subjected, it is obvious that this method of operation is unsatisfactory for temperatures substantially below 0°C.

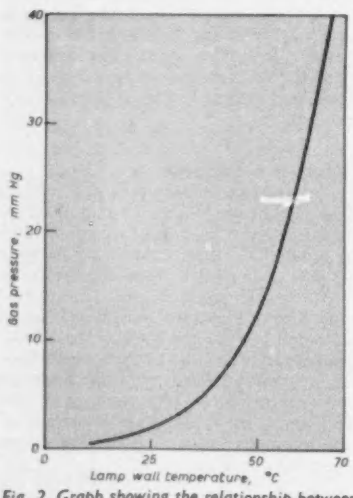


Fig. 2. Graph showing the relationship between internal argon gas pressure and lamp wall temperature in a 40 W fluorescent lamp

Thermal Switch Operation

Although the glow-switch is most suitable under normal temperature conditions, its mode of operation tends to be fast in comparison with the thermal starter-switch. In conditions encountered in refrigerated stores the much longer preheat period of the lamp electrodes obtained by using a thermal switch has a threefold effect. (a) During the preheating period the electrodes dissipate some 15 W to 20 W. This output, maintained over the longer period of closure of the thermal switch, supplies considerable heat energy to the gas mixture, (b) while the thermal switch is closed, electrons emitted by the electrodes are in a low strength electric field. Consequently, their velocity is low and collisions with atoms of the gas mainly result in loss of energy by the electrons to the gas, with gain in gas temperature, and (c) a local arc is maintained for a longer period on the lamp electrodes.

The substitution of thermal switches, with a relatively long closure time, for glow-switches in the circuits of the 40 W and 80 W lamps indicated in Table 1, gave satisfactory ignition within 10 sec to 15 sec at temperatures of −25°C at 200 V minimum, with preheat current approximately equal to the lamp running current.

The results indicate that for practical purposes, and from the viewpoint of ignition only, 4 ft 40 W and 5 ft 80 W lamps perform perfectly satisfactorily on mains supply voltages of 220 V a.c. at temperatures commonly encountered in cold-storage work, providing that thermal starter switches are used.

Operating Condition

The generation of light by a fluorescent lamp is dependent upon the emission of u.v. radiations by the discharge, this being ideally at the one wavelength to which the phosphor coating the inside wall of the envelope is most responsive. The only feasible way in which an electric discharge can emit a large proportion of its radiant energy at one wavelength is in the condition of resonance; that is, the radiation emitted by an atom when any of the excitation processes terminate in a return of the atom to the ground state. In a fluorescent lamp, the main resonance line produced by a discharge through mercury vapour occurs at a wavelength of 2,537 A°, and the optimum emission in this line is dependent, to a major degree, upon the correct vapour pressure being maintained.

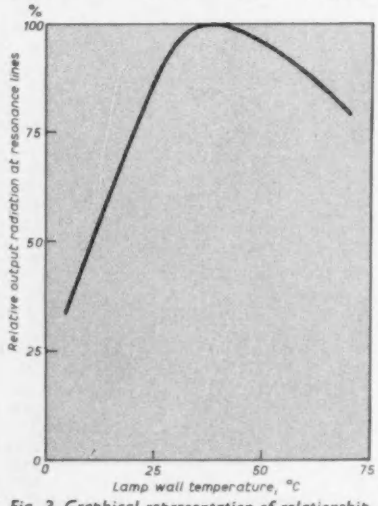


Fig. 3. Graphical representation of relationship between 2,537 A° energy generation and lamp wall temperature

The optimum mercury vapour pressure for fluorescent lamps with envelope diameters of 1½ in. is found to be about 5×10^{-3} mm. Hg. At lower pressures the mercury vapour becomes more rarified and the probability of collision between an electron and a mercury atom is lower; hence, the number of atoms in an excited state is less and the energy radiated at the 2,537 A° decreases with decreasing pressure. At higher pressures the mercury vapour becomes more dense and absorbs the resonance radiation before it reaches the phosphor coating on the inside wall of the fluorescent lamp envelope.

Temperature and Loading

Fig. 3 illustrates the variation in generation of energy at the 2,537 A° resonance lines with respect to the pressure of the mercury vapour. This shows that the optimum pressure is related to a lamp envelope temperature of around 40°C, which normally results with fluorescent lamps loaded at 10 W/ft in ambient temperatures of 20°C to 25°C.

Should the ambient temperature alter for the same tube loading, the wall temperature will also alter with a resultant decrease in the light output of the lamp. In the case under consideration—operation within the temperature range of +25° to −28°C—the fall-off in light output is more rapid per °C than for conditions of high ambient temperatures.

Any attempt to use fluorescent lamps at low temperatures must include means of maintaining the wall temperature of the lamp at a value as close to 40°C as possible to ensure efficient operation.

The simplest means is to reduce the rate of heat dissipation from the lamp wall by enclosing the lamp in an acrylic tube. The internal diameter of the tube must be large enough to entrap sufficient still air between the fluorescent lamp and the plastics tube to provide the necessary thermal insulation.

A further means of maintaining wall temperature is by selecting a lamp with the highest practical watts loading/ft of length. For a wall temperature of 40°C at an ambient of 20°C to 25°C the normal loading is 10 W/ft. For various reasons, however, the 80 W lamp has always been loaded to 16 W/ft. This results in a wall temperature of about 50°C under normal conditions and, as may be seen from Fig. 4, this results in a consequent slight lowering in efficiency by reason of the increased pressure. In fact, the 80 W fluorescent lamp operates at optimum efficiency (tube current and voltage constant) at about 15°C ambient.

The superiority of higher loaded lamps

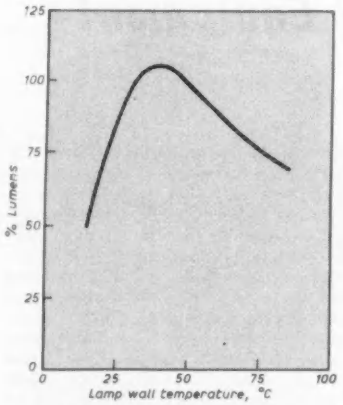


Fig. 4. Graphical relationship between efficiency and envelope temperature for an 80 W fluorescent lamp. 100% lumens = 25°C ambient on an inductive ballast

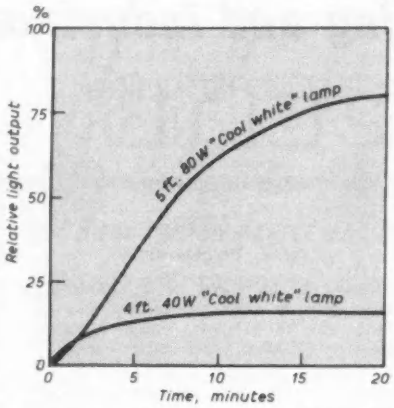


Fig. 5. Graph showing rise of light output with time after switching on at ambient temperature −25°C 4 ft, 40 W and 5 ft, 80 W lamps

under refrigerated conditions is indicated in Fig. 5. These typical curves refer to relative light output plotted against time for both the 4 ft 40 W lamp (10 W/ft) and the 5 ft 80 W lamp (16 W/ft), both being enclosed in an acrylic tube as described above.

The 100% output value of Fig. 5 refers to the light output of the respective lamps at the internationally agreed measuring temperature of 25°C. It will, therefore, be seen that the 80 W lamp operates at a value of some 20% below optimum in an ambient temperature of −25°C. To put this loss into perspective, it can reasonably be compared to the equivalent loss in light output resulting from enclosed or semi-enclosed fittings under "normal" conditions.

Multi-lamp Fittings

The wall temperature of an 80 W lamp operating in a comparatively well designed enclosed fitting was measured as 63°C. Referring to Fig. 4, this shows that the light output of the lamp can be expected to have decreased by some 17%. Multi-lamp fixtures inevitable increase this loss through internal dissipations and, consequently, the loss in light output experienced in the low temperature conditions of −25°C is comparable with normal design objectives.

The results of several tests indicate that lamps loaded at 10 W/ft and below are, in general, unsuitable for use in refrigerated conditions below about −5°C, even when mounted in the form of jacket described. The discharge in the case of the longer lamps is unstable and develops insufficient power to raise the pressure of mercury vapour sufficiently. As a consequence, the discharge has an abnormally high reignition voltage and, if continuously operated in this condition, the lamp life is rapidly shortened by the resultant bombardment of the electrode coating and cyclic restarting.

The foregoing indicates that the fluorescent lamps most easily applicable to refrigerated conditions are the 5 ft 80 W and 2 ft 40 W, which has the same W/ft loading but has not here been considered in any detail on account of its lower overall loading and efficiency. Accordingly, the 80 W lamp has been embodied in a relatively simple fitting designed for service in refrigerated coil deep-freeze chambers. Several large installations of these units are now in service.

Extended Run-up Time

Certain points of practical interest have emerged from the initial trials. In Fig. 5 is disclosed a phenomenon not observed with low pressure mercury lamps; the usual short "run-up" time to full illumination is extended to several minutes. This does not appear to inconvenience working in a store lighted by this means as, even at the instant of switch-on, sufficient light is available to provide adequate walk-way lighting. Moreover, the lighting switches are usually sited outside the store area. By the time the door has been opened and the loading sledges (trolleys) taken to the working areas of the stores, the lamps have reached full output. More usually the stores are in use continuously throughout the working day and lamps are switched on and off infrequently.

The by-products of ambient temperature variations in the store are of considerable importance. For example, when the store is commissioned, the temperature is gradually reduced to its final level over a period of several days. This is done to avoid undue structural stresses through contraction of the building materials. The air temperature may, therefore, be between 5°C and 0°C for several hours and, during this time, a considerable part of the moisture present in the air condenses. Care must be taken to protect the electrical components of the lighting fittings from ingress of moisture during this period and also during defrosting. This applies particularly to lamp-control gear and it is essential for choke ballasts to be of the solid filled type.

As the amount of free moisture in the store is limited, corrosion is restricted, except possibly in those regions adjacent to the doors. P.V.C.-covered wiring undergoes a certain small loss of flexibility at the temperatures experienced, but this involves no serious depreciation of insulating quality.

Lighting Layout

The lighting layout in refrigerated stores constitutes a compromise between good lighting practice, the engineering requirements of the refrigeration plant, and the stacking factors. The volume of the store obviously has to be used to its economic maximum. Consequently, the lighting layout must attempt to provide good overall coverage irrespective of the continuously shifting storage layout. The refrigeration plant utilises a large section of the ceiling and areas available for mounting lighting fixtures are limited. Furthermore, the fittings must be shielded from air movement or draughts which would reduce the surface temperature well below the operational limit of −25°C. Last but not least, while the lamps are physically protected by virtue of the acrylic jackets, mechanical handling aids must be manoeuvred with care to avoid damage to the lighting equipment

Fig. 6 shows a small section of the Ross Group refrigerated store at Grimsby. The store is operating at −25°C and serves to illustrate a number of the above points. This lighting installation has now been in service for over three years and the average illumination at floor level is approximately 20 lm to 25 lm/sq ft for a connected lighting load of 6·9 kW. The number of 80 W lamps installed is 72. The average life of the lamps is 3,000 hr to 4,000 hr which, in view of the arduous conditions of operation, is considered to be highly satisfactory both from an operating and economic point of view.

Fig. 6. View of a corner of the Ross Group refrigerated store at Grimsby showing a Philips 5 ft, 80 W fitting. This store contains 72 lighting fittings with a total load of 6·9 kW

Line Auto-reclosing and Industrial Equipment

HAZARDS OF OUT-OF-PHASE SYNCHRONISING

THE practice of clearing transitory faults on overhead transmission lines by tripping the circuit-breaker and then almost instantaneously reclosing is extensively used by supply authorities on both sides of the Atlantic. It is not normally applied to underground cable distribution systems since the self-capacity of the cables prevents effective clearing of transitory faults by the simple expedient of momentarily de-energising.

Reclosing Transients

To the industrial consumer who has a large installation of motors deriving supply from overhead lines, the break in supply of a few cycles may not be actually noticeable providing that load conditions are not such as to cause the motors to fall out of step by more than a few degrees. If the installation incorporates large synchronous motors—or is, more significantly, a generating plant operating in synchronism with the public supply—any degree of out-of-phase re-synchronising must be accompanied by transient current surges and mechanical torques, the magnitude of which will depend on the amount by which incoming supplies and the generated or re-generated voltage are out of step at the instant of reclosing.

It is, of course, possible to provide a protective relay which will ensure against an unsynchronised reclosure, but, in actual practice, reclosing is almost universally a function of time after tripping and, as a result, a degree of out-of-phase resynchronising is inevitable on reclosing.

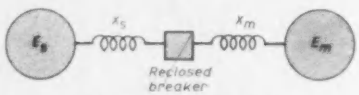
Estimation of Risk

The use of private generation operating in synchronism with the public supply is more common in the States than in Britain and, consequently, the problem is more pertinent there. Estimation of the risks involved with a particular plant is, therefore, important; and this aspect of supply was the subject of an interesting paper* presented at the twenty-third American Power Conference by G. W. Walsh, power systems engineer of the General Electric Company, Schenectady.

Apart from the damage to consumers' equipment, the distribution system components may also be damaged by high transient currents of the magnitudes that attend out-of-phase reclosing. True, actual incidents of equipment damage have been infrequent, partly because of special precautions taken in areas where vulnerable equipment is located and partly because of the existence of factors which help to reduce the peaks of transients to values far below maximum.

Nevertheless, the uncertainty which attends the extension of auto-reclosing techniques in areas where equipment is vulnerable to transients makes it necessary to establish some means whereby a tolerably accurate estimation of the magnitude of such transients can be determined.

* Summary of paper presented at the 23rd annual meeting of the American Power Conference. The report of the conference proceedings will be published in the USA in November.



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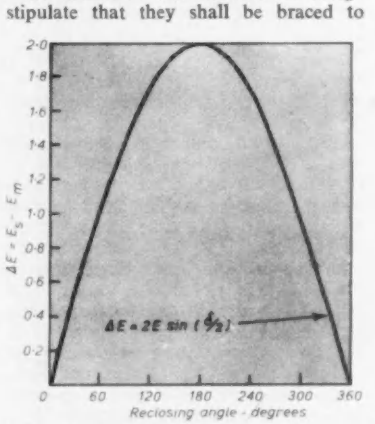

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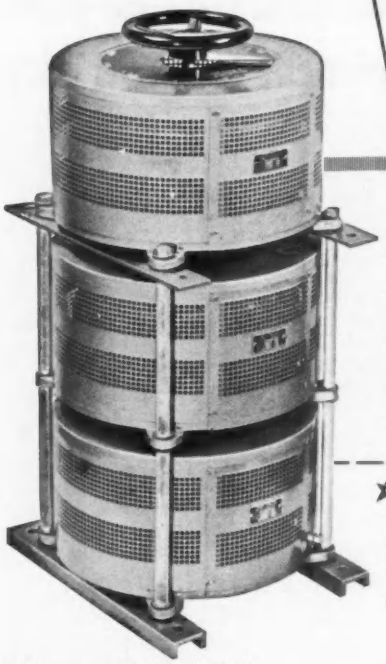

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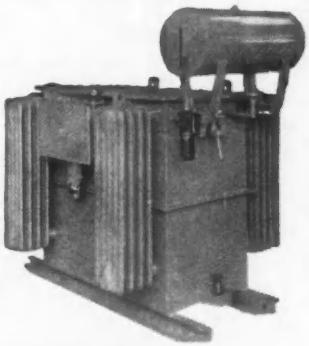

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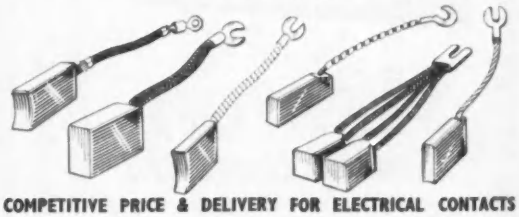

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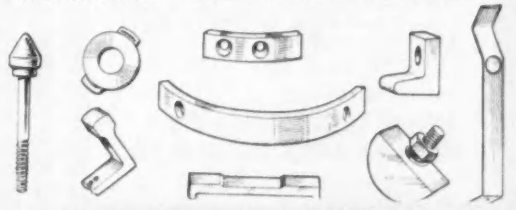

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Line Auto-reclosing and Industrial Equipment

HAZARDS OF OUT-OF-PHASE SYNCHRONISING

THE practice of clearing transitory faults on overhead transmission lines by tripping the circuit-breaker and then almost instantaneously reclosing is extensively used by supply authorities on both sides of the Atlantic. It is not normally applied to underground cable distribution systems since the self-capacity of the cables prevents effective clearing of transitory faults by the simple expedient of momentarily de-energising.

Reclosing Transients

To the industrial consumer who has a large installation of motors deriving supply from overhead lines, the break in supply of a few cycles may not be actually noticeable providing that load conditions are not such as to cause the motors to fall out of step by more than a few degrees. If the installation incorporates large synchronous motors—or is, more significantly, a generating plant operating in synchronism with the public supply—any degree of out-of-phase resynchronising must be accompanied by transient current surges and mechanical torques, the magnitude of which will depend on the amount by which incoming supplies and the generated or regenerated voltage are out of step at the instant of reclosing.

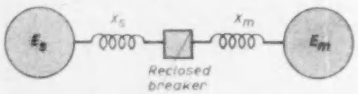
It is, of course, possible to provide a protective relay which will ensure against an unsynchronised reclosure, but, in actual practice, reclosing is almost universally a function of time after tripping and, as a result, a degree of out-of-phase resynchronising is inevitable on reclosing.

Estimation of Risk

The use of private generation operating in synchronism with the public supply is more common in the States than in Britain and, consequently, the problem is more pertinent there. Estimation of the risks involved with a particular plant is, therefore, important; and this aspect of supply was the subject of an interesting paper* presented at the twenty-third American Power Conference by G. W. Walsh, power systems engineer of the General Electric Company, Schenectady.

Apart from the damage to consumers' equipment, the distribution system components may also be damaged by high transient currents of the magnitudes that attend out-of-phase reclosing. True, actual incidents of equipment damage have been infrequent, partly because of special precautions taken in areas where vulnerable equipment is located and partly because of the existence of factors which help to reduce the peaks of transients to values far below maximum.

Nevertheless, the uncertainty which attends the extension of auto-reclosing techniques in areas where equipment is vulnerable to transients makes it necessary to establish some means whereby a tolerably accurate estimation of the magnitude of such transients can be determined.



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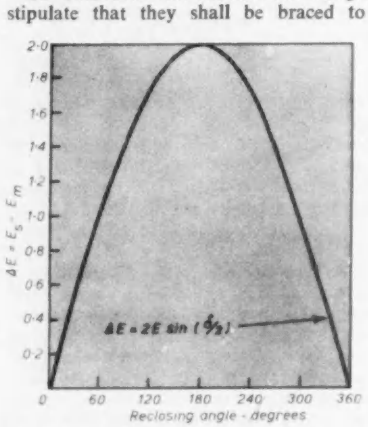

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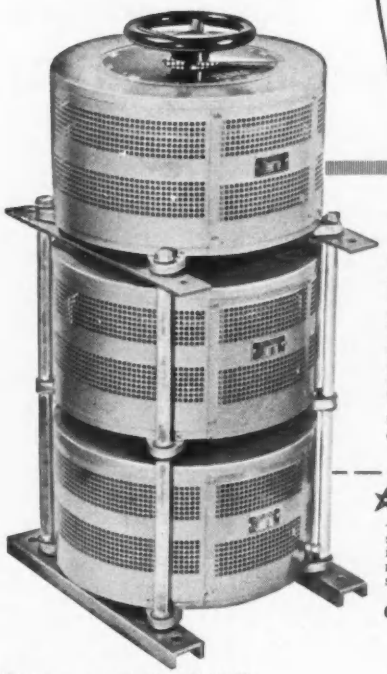

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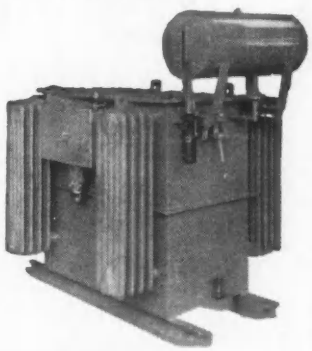

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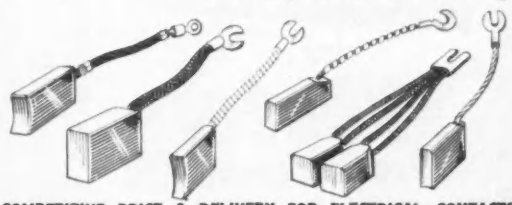

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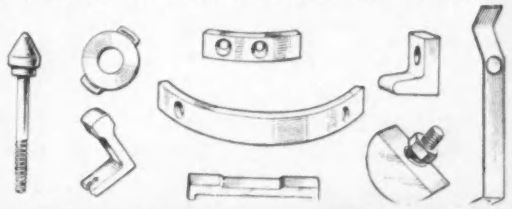

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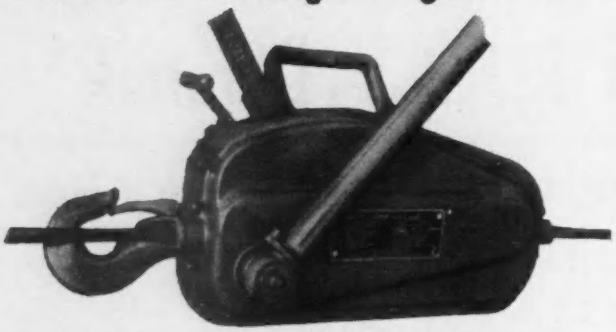

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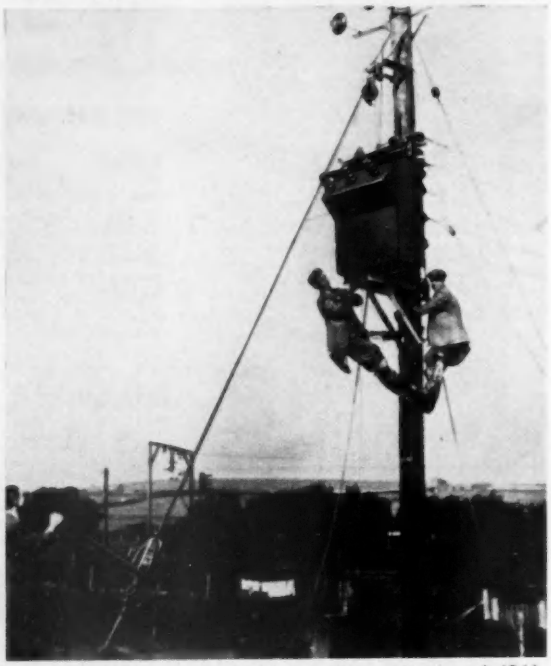

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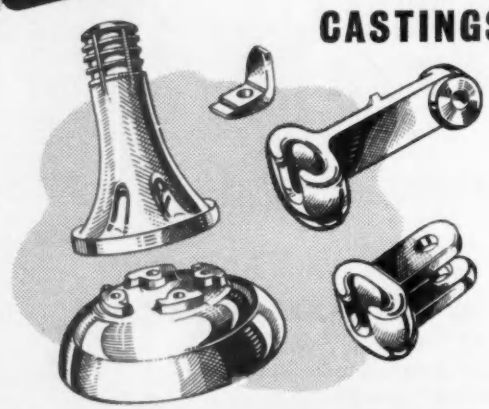

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"Flats" on Alternator Slip-rings

POSSIBLE CAUSES OF "GHOSTING"

by J. S. Ridler and P. Ridler

A COMMONLY observed phenomenon on alternator slip-rings which have been in service for some time is the formation of blemishes of distinctive pattern at one or more points which may, in time, develop into flats or extended areas of roughening of the slip-ring surface. In many cases the shape of the blemish approximates to that of the brushes in contact with the slip-ring, for which reason they have been referred to as "ghosts" and the phenomena in general as "ghosting."

In an endeavour to determine the cause of "ghosting," and to establish whether there was, indeed, a connection between the shape of the blemish and the brush section, a set of brushes were given shallow identification slots in their faces, cut by a hacksaw as in Fig. 1, to a variety of patterns. These were then inserted into the brush holders of an alternator and run for periods with current passing through them.

Forming a "Ghost"

After a short period of running, a set of "ghosts" appeared, one for each brush, and with the identification slots clearly visible and distinguishable. The clarity of the imprint would appear to indicate that the action producing it must be instantaneous and repeated at regular intervals. The next step was to determine the probable cause and the reason why the "ghosts" should appear at the particular spot on the rings. One source that could affect the ring and the brushes is the rotor connection to the slip-ring and indeed, the "ghosts" appear in close proximity to this point. This connection, marked RC in the diagrams, carries the full rotor current and passes under each brush in turn once every revolution.

On a ring with only one brush, the full current is carried by the brush all of the time (Fig. 2). Where there are two brushes, spaced 180° apart, the relative position of RC to each brush will determine the proportionate distribution of the current between them at any instant.

Fig. 1. Brush sections with identification slots

When RC is mid-way between brushes B_1 and B_2 (Fig. 3a) the current will divide equally between the two but, as RC recedes from one and approaches the other, the current will fall in the one and rise in the other, reaching a maximum in each brush consecutively when the radial centre lines of RC and the brushes coincide (Fig. 3b).

Peak Current Values

The peak values of these currents will be considerably above the average value —i.e., total current/number of brushes— for a very small fraction of time. For example, with two brushes on a ring of 1 in. thickness and 24 in. circumference, the ring resistance ratio between RC and each brush will vary between 1:6 and 6:6. That is, when RC is immediately below B_1, there is only 1 in. thickness of ring between RC and the brush; the resistance between RC and the other brush at the same time is that of two halves of the ring in parallel, i.e., one 6 in. path of the ring. When RC is midway, the current is equally shared (Fig. 3a).

Let us suppose that the excitation current carried by the ring is 49 A. With RC immediately under B_1, the brush would supply 42 A while brush B_2 would supply only 7 A. That is to say, the current in each brush rises and falls cyclically between 7 A and 42 A with each revolution. Since the heat generated at the ring/brush interface is a function of the square of the current carried, it is apparent that, at the instant that RC passes under either brush, the localised heating index is of the order of 1,764 as compared with 49 in the opposite brush, and a mean of 600 ($24{\cdot}5^2$) for which the brush was designed. Such proportionate values could account for the burning observed in the vicinity of RC on the ring.

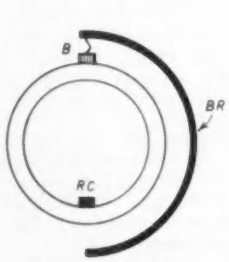
Multi-brush Machines

In a multi-brush machine, involving the transmission of heavier currents, the effects can be greatly magnified (Fig. 4). Assuming a current of 240 A flowing with four brushes, an average flow per brush would be 60 A, corresponding to a heating index of 3,600. In fact, the current distribution will be more like that shown with the first brush carrying about 162 A, corresponding to a heating index of 26,244, over seven times as great as designed for.

The constant in the heating index is the product of contact resistance and the time that the current flows. While the latter is extremely small, it occurs 50 times a second on a two-pole alternator and the cumulative effect is well able to make an impression on the ring surface.

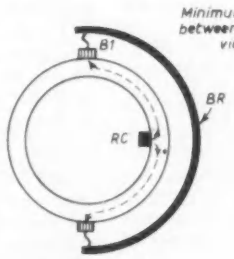
There is also anodic transfer of ring material from the negative slip-ring to the carbon brush, the rate of which is proportional to the current density. The transfer of metal naturally erodes the slip-ring and the dual effect of heating and anodic transfer simultaneously, localised in the area directly adjacent to the rotor connection RC as it passes below each brush—and where the current flow is at its high peak—is sufficient to cause the local burning/erosion in the shape of the brush.

Another possible contributory factor is the effect of the high magnetic forces around the brush and its connecting tails tending to move it across the field and so reducing the contact pressure. The amount may be minute, but contact resistance is extremely sensitive to pressure. Since no current passes across the identification slot, this area is left uneroded.

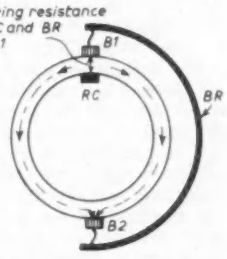


Single brush. B carries all the current without variation

Fig. 2. Single-brush condition.



With RC in this position B1 and B2 share current equally



Two parallel paths between RC and BR via B2 = one 6" path of resistance

Fig. 3a. Two-brush condition, RC midway, (3b) in line with brushes

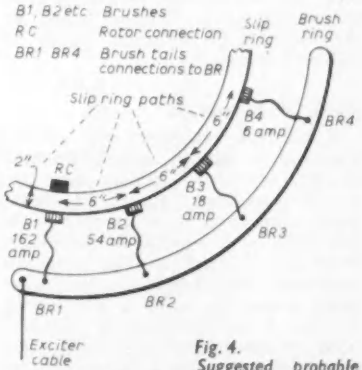


Fig. 4. Suggested probable distribution of current between brushes on a hypothetical multi-brush alternator, 240 A excitation current

Electricity, Maintenance and Mining

"THE history of the use of large amounts of electrical power at the coal face is the history of the fight against electrical resistance and the heat it occasions." Mr J. N. L. Woodley, B.SC., A.M.I.E.E., A.M.I.MIN.E., area chief engineer in the Durham Division, in a paper* presented before the annual convention of the Association of Mining, Electrical and Mechanical Engineers at Harrogate this year, pointed out that the great changes in post-war designs of powered coal-face equipment were due largely to the substantial progress which had been made with insulation in meeting the onerous thermal conditions underground.

In particular, textile and vegetable insulants have been largely superseded by the use of glass fibre or nylon, sealed and strengthened by silicone or synthetic resin impregnants, which give both better dissipation of internally generated heat and better resistance to elevated temperatures. The oil-filled transformer has always been regarded with apprehension by mining electrical engineers, but actually its safety record has proved exemplary. Now the recently developed f.l.p. transformers, incorporating an interesting cooling pattern between winding and tank, are still further helping to allay those fears.

Flexibility of the last 200 yd of trailer cable between gateway and coalface appliance is a major problem as larger motors become necessary. It is becoming apparent that 1,100 V equipment has distinct advantages without introducing undue design problems or increasing hazards.

Maintenance

The traditional system of maintenance in the coal mining industry is "breakdown maintenance." This implies overhaul and repair only after a machine has broken down. With greater dependence on powered equipment at the face it is wasteful and should be superseded by "planned maintenance." This involves the taking of a machine out of service for overhaul at planned intervals without affecting output and it ensures against failure at the face with its attendant hazards and loss of production.

Economically, the only factor to consider is the comparison between the cost of operating the programme and the alternative of breakdown costs in repairs and lost output. Planned maintenance must be intelligently conceived.

Major examinations of plant depend for their effectiveness on the vigilance of the men who carry them out. They are not likely to do them effectively unless a proper allowance of time has been allocated. Local examinations, generally aimed at safety, lubrication and adjustment for wear, are difficult to ensure if a high proportion disclose no defect. There must be adequate supervision and, equally important, the operators must appreciate the value to themselves and to the machine of intelligent handling. Even a limited knowledge of the internal workings of the plant, both mechanical and electrical, can do much to ensure against unnecessary breakdown. This can be achieved by short instructional courses at special centres or in central workshops.

Good communication between machine and workshops is a vital aid to the prevention of breakdown. It implies more than just a workable telephone system. It means that the man working the machine can readily recognise any irregularity of performance and can intelligently convey to the maintenance engineer at the other end of the line such information as will enable him to form an opinion of the probable trouble and collect the appropriate equipment.

Repair Procedures

An important aspect of repair procedure is, paradoxically, knowing when to replace instead of repair. Repairs may arise from unexpected failure, normal operational wear of component parts and just plain *anno Domini*. It is never economic to operate a machine which is bordering on obsolescence.

The presidential address by J. Anderson, M.B.E., dealt with the responsibilities of management, and the W. M. Thornton lecture this year was given by A. R. Cooper, M.ENG., M.I.E.E., M.INST.F., of the CEGB. W. V. Sheppard, B.SC., M.I.MIN.E., spoke on the achievement of higher productivity from better use of horsepower at the coalface.

* "Engineering in the Vicinity of the Coal Face—Mechanical and Electrical Aspects."

LIGHTNING AND COLLIERY STRUCTURES

IT is a natural result of the general form of headworks structure at the average colliery that they should be vulnerable to lightning strokes in a degree which is dependent mainly on location, shape and resistance to earth. The provision of lightning arresters is, therefore, highly advisable and, indeed, vital where stores for explosives are in the vicinity.

Guidance for the protection of buildings, based on experience over many years, is given in the British Standard Code of Practice, CP326.101(1948): "Protection of Structures Against Lightning," and this has been used as the basis of an information bulletin* issued by the NCB with particular regard to colliery locations.

Zone of Protection

It has been established that a cone-shaped zone, with an angle at the apex of 90°, around a lightning conductor is safe from some 90% of all strokes which come to earth in the vicinity. In few cases is it possible to completely cover an area from a single conductor unless the vertical height protrudes excessively above the roof of the highest building. It is more usual to provide a series of conductors with overlapping zones. In some cases a large area may be protected by an arrangement of shield wires bridging the gap between two or more conductors. Since the leading stroke of a lightning flash has a steep wave front, impedance of the earth path rates higher than actual ohmic resistance. The conductors must, therefore, be as straight as possible with the largest radius curves where deviation from the straight is unavoidable. Sharp bends will inevitably lead to side flashes from the "rod" to adjacent brick or stone structures with considerable damage.

Earth Termination

A good earth is essential and the BS Code recommends a maximum earth resistance of 10 ohms (7 ohms in the case of explosives and oil stores), which can be achieved by single or multiple earthing electrodes in parallel for each conductor. In no circumstances should the earth be made to the earthing plates of electrical equipment in the buildings.

The bulletin gives some helpful information on joints and bonding of lightning conductors and the steps which should be taken to protect special structures. The test methods to ensure earth resistance complying with the Code under all conditions, wet or dry, of the ground are described as well as the dimensions and materials of lightning protection equipment as recommended.

*"Protection of Colliery Structures Against Lightning." NCB Information Bulletin 61/223, issued by the Production and Reconstruction Department.

HOW RIGHT ARE YOUR BRUSHES?

MESSRS Morganite Carbon Ltd. have asked us to correct a confusion of impressions which might arise from reading the article on page 797 of the 18 May issue. This arises from the graph in Fig. 3 which relates to butt-contact pressure in contactors, etc., and not to motor brushes. Similarly, the reference to "refractory" carbon base for commutator brushes should have read "graphitised." Refractory carbon is used mainly in the manufacture of butt-contacts, the metal carbon series of which is accorded the DM Group Identification. It is used in brushes mainly for special short-time, high-duty applications such as starter motors for cars, aircraft, etc.

Can ring-circuits be improved?

INADEQUATE WIRING STILL BARS ELECTRICAL PROGRESS

by Philip Honey, A.M.I.E.E.

IT is nearly 14 years since the ring-circuit received official sanction in the IEE Wiring Regulations, and although it is the exception today to find a new house without a ring-circuit, can one say that it has been the success its promoters hoped it would be? The dismal fact is that with the exception of relatively few non-speculatively built houses the majority of new dwellings have no more socket-outlets in them than were installed by builders in the 1930s.

This was the very difficulty the ring-circuit was designed to overcome, to provide more socket-outlets at a lower price per point using less cable. It was hoped too that it would overcome for ever the confusion of plug and socket sizes of which the public had long complained.

Inadequate Wiring

One finds instead that the old pre-war "standard" of one socket-outlet per room still persists. Indeed, some speculative builders currently list this as a feature of their so-called labour-saving houses. The ring-circuit is installed in such houses today, not because it enables the purchaser to have an adequate number of socket-outlets included in the purchase price, but because it is cheaper and simpler to install than the old traditional "distributive" system even for a minimum of one socket per room.

What is more disturbing is the fact that the cause of adequate wiring is being frustrated by the present lack of appreciation by the builder. He has yet to be convinced of the urgent need, in the interests of safety and convenience, to provide the house purchaser with an electrical installation which will cater for the many electrical appliances he possesses today, and will, no doubt, buy in the future.

No blame for this can be laid at the door of the electrical industry. The price of a so-called "power point" installation is relatively lower today than it was in 1939, taking into account the fall in the value of money. Yet one hears again and again that the house purchaser has to pay outrageous prices for any extra socket-outlets he wishes to have installed. Obviously the low cost of installing sockets, which is a feature of the ring-circuit, is not being passed on to the house purchaser.

Under the old distributive system of wiring, with individual circuits for each socket-outlet, extra points required long runs of cable from the main distribution fuse board together with additional fuse ways for each circuit. Today, with the ring-circuit, an extra socket-outlet may need comparatively little extra cable, or even none at all, yet the price per point, which builders charge their clients, takes no account of the economies of the ring-circuit.

The basic cost of extra socket-outlets added to an installation of, say, ten sockets, is reckoned by them to be one-tenth of the contract price each, with no reduction for quantities. To this the builder adds his own profit and the result is a much inflated price per point, which makes it costly to have a really adequate installation.

Architects' Criticisms

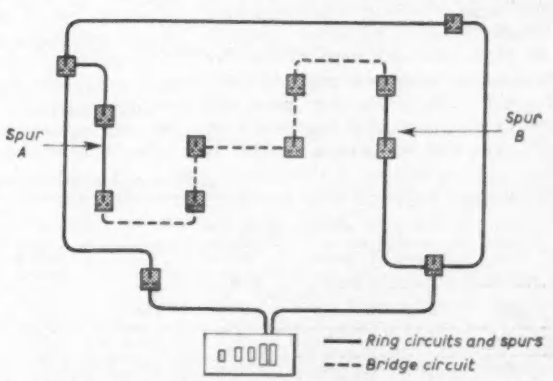
It has taken some years for the architect to appreciate the advantages of the ring-circuit, but now that the architectural student takes the subject of electrical installations as one of the essential features of his course of instruction there is a greater awareness of the importance of providing adequate wiring. This can be seen particularly in larger buildings.

The looker-on, it is said, sees more of the game than the player, and it is interesting to record some of the observations of prominent architects who, while recognising the need for adequate wiring, are critical of the way we go about it. He are some of their criticisms:

(1) *We do not plan the route of the ring-circuit with a view to making it 100% useful.* They say that we often run the ring-circuit cable across a floor rather than round a wall. This may save a few yards of cable but where the cable crosses the floor it obviously cannot serve any socket-outlets. A more intelligently planned ring would give greater freedom in spacing the sockets and would make it possible to provide many more of them at no great cost.

(2) *We ought to plan the ring-circuit so that additional socket-outlets could be easily installed subsequently.* This means that the ring-circuit cable should be placed where sockets might be wanted in future. Or at least provision should be made for cable to be drawn into ducts or hollow skirtings so that existing cables could be tapped or spurs added at a future date.

(3) *The difficulty is recognised of installing an extra socket-outlet on to an existing cable buried under plaster.* This is because the cable has to be cut and then there is not sufficient slack to enable the conductors to be looped into the socket terminals. Architects ask why is it necessary to cut the ring-circuit cable? Wouldn't it be better practice to run the cable in one length complete and to clamp the connections on to



By bridging wiring between spurs additional outlet positions can be obtained economically and the ring-circuit is strengthened

the conductors? When one realises the difficulty of cramming as much as 21 strands of 0·029 in. conductor into a socket-outlet terminal (e.g., where a spur joins the ring) the wonder is that we have tolerated it for so long.

Several architects have asked why we do not design a simple accessory which could be clamped to the three ring-circuit conductors without cutting them to provide for connection of a socket-outlet. The actual outlet would be provided with three bare pins, which would be plugged into holes in the accessory connected to the ring and then secured in position. Terminals and facilities for connection of a spur could be provided in a similar way.

(4) *Why does the electrical industry still use the old BS 546 pattern plugs and sockets?* Architects say that for years the public has asked us to put an end to the confusion of sizes of plugs and sockets yet we still provide 2 A or 5 A points as well as 13 A in spite of the fact that the BS 1363 plug and socket was introduced to end this confusion.

These views command respect. It is up to the industry to take notice of them if it wants adequate wiring to be the success it must be, if consumers are to make proper use of electrical facilities.

Eliminating Spurs

The original idea of the ring-circuit was undoubtedly a plain ring—pure and simple. The spur, with its permitted maximum of two socket-outlets, must have been an afterthought. Technically it is an objectionable feature chiefly because it is possible for a load of 26 A to be applied to a 20 A (7/0·029 in.) cable. Some installation engineers avoid spurs as far as possible when designing the installation, preferring to add to the length of the ring-circuit where necessary, so as to keep as many socket-outlets on the ring itself.

It may be asked if anyone has given any thought to the possibility of *bridging* the ring rather than connecting spurs to it? The diagram shows a plan of a simple layout of a ring-circuit with the maximum number of spurs (each with two socket-outlets) connected to it.

The provision of a further number of outlets by spurs is impossible without adding an equivalent number to the ring itself. If, however, Spur A is connected to Spur B (shown in dotted line) they are spurs no longer but become instead a bridge, which is, in fact, a part of the ring. It will be seen that the bridge can have as many socket-outlets as desired directly connected to it.

Perhaps the IEE could give the new principle of "bridging the ring" its official blessing as there appears to be nothing in the wiring Regulations which could make it objectionable. In fact, the ring-circuit is strengthened electrically by bridging it, as it adds an additional parallel path for the current to pass in both directions. The ring-circuit could, in fact, become a grid-circuit if it was bridged at more than one place.

Conclusion

The ring-circuit encountered some opposition from within and without the industry when it was first introduced. Today it is universally accepted as a big step forward in electrical installation practice. Unfortunately the ring-circuit has not achieved the object which was originally intended—to provide more outlets, conveniently and economically. This object must be achieved or, like the roads of Britain, the household circuit will be totally unable to accept future traffic.

The Editor of the ELECTRICAL TIMES said on the BBC a little while ago that every year, on an average, every family in the country bought a new electrical appliance for use in the home. Obviously there must be socket-outlets available for each of these new appliances. If not, one day we shall awake to the fact that electricity consumers have stopped buying appliances simply because there won't be any points in which to plug them.

Supply in the O.E.E.C. countries

AN annual rate of rise of electricity consumption in the OEEC countries of 7·2% is predicted in a report: "The Electricity Supply Industry in Europe," published recently by OEEC and available in this country from HM Stationery Office. In 1959 there was slightly increased electricity consumption on the two previous years at 7%, and an even higher increase of 8·9% is anticipated for 1960 when complete figures are available.

In 1959, generating capacity rose by the relatively high percentage of 8·4% to 134·7 GW, while the figure for thermal plant alone was even higher at 9·8%. For 1960 an increase of 7·8% is anticipated, bringing the total installed generating capacity for the OEEC countries to 145·3 GW. The proportion of hydro capacity has shown a slight decline in recent years, but generation by nuclear power and natural gas have strengthened. The proportion of nuclear generation, 0·3% in 1960, is expected to rise to 2·3% by 1965. Improvements in generating plant are reflected in the thermal efficiencies, which rose from 26% to 26·4% from 1958 to 1959, the last year for which complete figures are given.

Coal continues as the main fuel; oil consumption showed an increase of 30% for 1959, compared with 1958.

The advantages of interconnecting the continental power systems are clear from figures for power interchange published in the report. Interchange among the OEEC countries amounted to 8,627 GWh during 1959, while a further 481 GWh were exported by these countries to countries outside the organisation. In 1959, when water conditions were favourable, countries with predominantly hydro generation exported considerable quantities of energy to the countries with a high proportion of thermal plant. Thus, France, Switzerland and Austria all increased their exports appreciably under this arrangement.

OEEC power statistics for 1959 with estimates for 1960-65.

Year	Mx Plant capacity GW				Power production TWh				Consumption TWh Total	Power interchange between countries GWh	
	Thermal	Nuclear	Hydro	Total	Thermal median‡	Nuclear	Hydro median	Total median		Import	Export
1959*	83·2	0·23	51·3	134·7	290·3	1·2	190·6	482·1	429·0	9·5	10·9
1960†	90·1	0·4	54·7	145·3	321·0	2·0	207·0	530·0	467·3	8·7	9·0
1965†	116·6	4·3	72·4	193·2	471·0		270·0	742·0	654·0	9·6	11·1

1 GW = 1,000 MW. 1 TWh = 10^6 MWh. * Actual. † Estimated. ‡ The median value is based on average hydro conditions.

Wholesaling in the sixties

IMPROVED EFFICIENCY AIM OF ELECTRICAL TRADE

TRADING today is in a ferment in every industry. As manufacturers decrease the factory cost of their products, distribution costs loom larger in the competition-significant final cost to the ultimate purchaser. The wholesaler, concerned exclusively with distribution, is most intensely involved in this development. In the electrical industry, as in most others, he is reacting through concentrating attention on the details of his activities; through examining his established ways of conducting his trade for possible improvements in efficiency.

1961, with so much concentration of manufacturing capacity achieved in the electrical industry, and Parliamentary intervention in regulating trading still rife, is an appropriate time to examine electrical wholesaling, to check on the wholesaler's willingness to seek improvement.

The importance of detail has already been mentioned. The wholesaler, more than any other element in the distribution system, is concerned with detail. He is essentially an aggregator of numerous small items of paper work, a storer of large numbers of products, a carrier of many packages. It is detail, then, that must have his attention if he is to improve in efficiency as measured in terms of a better service for no higher unit return.

Comparative Performance

The attack on detail so far as members of the Electrical Wholesalers' Federation are concerned is informed by the scheme of inter-firm comparison that has been introduced recently. Here, it is the annual accounts of firms that provide the working tools for investigating ways to improvement. Firms co-operating in the scheme make their accounts available on a confidential basis to professional accountants. These extract generalised ratios, covering such matters as stock levels and operating margins. Co-operating firms are informed of the average figures, wholesalers being divided into four groups by magnitude of turnover, to enhance the significance of the averages.

Such information can be used to improve detail through application of management's business ability to interpret the difference between realised performance and the general level. If a particular ratio for the firm departs unfavourably from the average for organisations in the appropriate size classification, it may be due to departure of customer-pattern from the norm; a higher proportion of expensive-to-service customers, for example. Or it can be due to less efficient organisation or ill-trained staff or other correctible faults.

In any case, the wholesaler has a warning. In today's atmosphere of competition, he is unwise to ignore it. He can see where closer analysis of his organisation and trading methods is likely to be rewarding.

Inter-firm comparison is being accepted as worth while in electrical wholesaling. That is itself a measure of the sensitiveness of the trade to the need to build up efficiency. Although the technique smacks of lifting oneself by one's bootlaces, it remains true that the more efficient the trade is as a whole, the more successful the most efficient firms are likely to be. They will probably make best use of the information inter-firm comparison brings. And much of the advantage passes to customers.

Accompanying the comparison of accounts details, there is abroad a greater willingness amongst wholesalers to discuss the minutiae of their business, again evidence of the belief that improvement in efficiency of the trade as a whole is important, as an influence in bettering the performance of individual firms. But in one respect relatively little progress seems to be made. There is less activity in new building and radical reconstruction of premises than might be thought worthwhile from consideration of other trades. Not much weight is being attached to advantages of out-city siting to easier distribution, or of factory-developed techniques applied to warehouse handling of goods, both of which seem significant at first consideration.

It is not easy to see why this possibility of greater efficiency should be so ignored; although such changes demand capital spending, never welcome today. A factor undoubtedly is that in essence, successful wholesaling depends on possession of an efficient staff. Well-planned and sited premises are of little account if the staff is of indifferent quality. However, since wholesalers are doing little about buildings, one might expect to find them doing more to improve their quality of staff.

Manufacturers

However much wholesalers improve their work, they can never be discussed in isolation from the manufacturers and the trade outlets they serve. It is in changes in the attitude of customers that the challenge of the sixties is spelt out for wholesalers. One aspect of this, much in the news currently, is the tendency of manufacturers to limit the handling of their products to nominated wholesalers. A complementary trend is for wholesalers to choose to deal with only a limited range of manufacturers. These trends in the trade raise the question, what is required of wholesalers by electrical manufacturers?

The first demand of the electrical manufacturer is for countrywide coverage of warehouses. He wants stocks of his goods accessible to purchasers wherever they be. That does not imply any heavy preference for wholesaling organisations which themselves have national coverage. In the more remote areas, it is in any case probable that the small or medium sized local firm will be the best placed to give the service.

The second requirement is ability and willingness to hold a sizeable stock, so important a factor in good wholesaling. It is a quality that over the past 15 years, manufacturers have tended to discourage, perhaps unintentionally, by their drive in setting up local branches. Currently, a reverse trend seems to be setting in, with a reduction in number of branches. This reflects emphasis

by the manufacturer on competition on a cost and quality basis, relying on the wholesaler for service or delivery.

More contentious is the degree to which a wholesaler who has been appointed as distributor of an appliance manufacturer's products, should put any special effort into promoting sales of them. There are obvious claims in this direction, but there is also a clear body of opinion that argues that the wholesaler cannot afford to become closely involved in promoting any one manufacturer's product. There is also a question of what staff skills the wholesaler should employ.

An argument that has been advanced, is that appliance manufacturers should recognise this sales position by distributing through wholesalers, who can offer the premises, paper-handling and transporting expertise and finance; but that these manufacturers should maintain their own contact with retailers through a public relations-publicity staff, concerned with advising retailers on how to sell particular appliances most effectively. Those who support this approach do not envisage cutting off the wholesaler from distribution of publicity material; but he would not be concerned with how to put it to its most effective use.

Trade Relationships

It is the manufacturer who is involved when specialist wholesalers are appointed to handle electrical appliances. Another development much in the news in trading generally is the "voluntary group," a set of retailers with their own wholesaling organisation, or committed to taking supplies from a particular wholesaler. The wholesaler, in turn, offers extra facilities to the retailers. In present trading circumstances, one stumbling block to building up voluntary groups in the electrical trade seems to be the varied nature of retail outlets for electrical appliances. Apart from electrical contractors and radio and electrical appliance dealers, there are area boards, ironmongers for some appliances, chemists' shops for others. No wholesaler is likely to have only one type of customer, capable of fitting neatly into a voluntary group arrangement.

In terms of the service the wholesaler at the centre of a voluntary group might be expected to offer his retailer associates, the difficulty about manufacturer-identification already discussed arises. Hard advice on display and selling means almost inevitably, advice to favour one manufacturer's product rather than another's. The electrical wholesaler is open to attack if he shows any such tendency; avoidance of partiality amongst the equipment he handles is an important consideration in his trade standing.

Those who argue for voluntary groups will answer that the economics of the trading situation forcibly press the advantages of the system if use of wholesalers is to be kept sufficiently attractive to manufacturers, as an alternative to direct distribution. But so far they can point to no startling success to support them.

An element in the situation, which those discussing it cannot afford to ignore, is the legal position about resale price maintenance. It seems that if the right to impose maintenance of resale prices at every stage of the distribution chain were lost, then the voluntary groups principle might receive a fillip, despite the difficulties of applying it in electrical trade.

A special case for checking on wholesaling efficiency relates to the area electricity boards. These have the opportunity of dealing directly with manufacturers, in view of the size of their aggregated purchasing, yet more and more they are looking to electrical wholesalers to supply their showrooms. The question can be argued from many angles, but currently one seems to have the ascendency. It is, that an area board is a commercial organisation committed to using capital in its specialist task, supplying electricity. Its showrooms provide, in effect, a chain store organisation, so far as appliance selling is concerned, but they should have minimum call on capital. That line of argument points to the use of electrical wholesalers as suppliers.

R.T.P. Act

The Restrictive Trade Practices Act has been mentioned briefly already; but of course its influence pervades every facet of trading in Britain today, nowhere more effectively than in the electrical field. The immediate effect of the Act has been that negotiation between organised manufacturers and organised wholesalers is ruled out. The search for efficiency demands that some other technique, less effective perhaps, but still conducive to orderly trading and the highest common denominator of mutual interest, should take its place. It has been found in "exchange of views." This is the technique being increasingly developed today, when negotiations and subsequent recommendation to members is ruled out. All that can be attempted is to ensure that the corporate thoughts of one part of the trade are known to the other. Agreements, formal or informal, are impracticable.

With the exchange of views techniques goes price leadership—and trade practice leadership goes with that, something in which the electrical wholesaler is essentially more interested than in price *per se*. Leadership in a given field of specialised manufacture may not lie with one firm alone; the representatives of wholesalers must exercise their influence broadly. But they are not completely powerless even within the restrictions of the Act.

Section 25 of the RTP Act gives the manufacturer the right to enforce resale price maintenance. It is currently under consideration at Government level. Were it to be removed as a right, the change might do much to change the pattern of wholesaling.

International Links

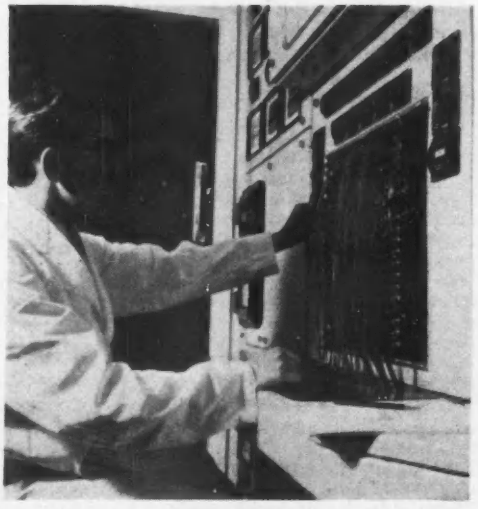
Efficiency in wholesaling has many facets, as this article has indicated. One of old importance, now receiving renewed attention, is broadness of sources of supply, the willingness to handle overseas products as well as British. Wholesalers are importers today. They are linked, so far as the EWF is concerned, with electrical wholesalers in other European countries. There is an organisation whose essential aim is to raise the overall level of wholesaling efficiency, through mutual comparison of practice and experience. An incidental of the contacts that such co-operation brings is increased assurance about specific foreign sources of supply (a two-way effect this, the better British manufacturers gaining as well through what factors in overseas countries are told about them).

It was said earlier that wholesaling is essentially sensitive to influences from manufacturers, contractors and retailers. That must limit the validity of conclusions drawn from the standpoint of the wholesaler alone. But it is clear that in most respects, a determined effort is being made by many firms to meet the challenge of the sixties with initiative and aggression, rather than the continued application of established, but ageing, techniques. It seems as well that the position of the electrical wholesaler in its essentials of being a merchant, remains secure. Gimmicks of new trading alignments may help and expand the business, they are not essential to its vitality.

A temperature check in progress on a sheathed wire heating element in one of the laboratories at the centre

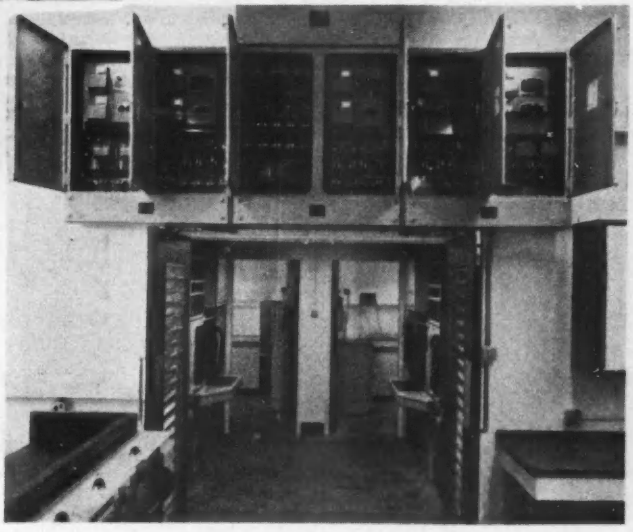
Eye on Domestic Appliance Research

DOMESTIC appliances of today and those of tomorrow have to be backed by intensive research and massive technical resources if they are to succeed. Upholding this concept are AEI-Hotpoint, who have equipped a £250,000 research and development centre at their Peterborough factory. This was opened last week by AEI chairman Lord Chandos. The scope of the centre's work goes beyond comparison of engineering techniques employed by competing manufacturers and is closely linked to developments in fundamental research such as that being undertaken elsewhere in the group on thermo-electric refrigeration. Research is also being extended into a wide range of materials, among which experiments on new plastics figure strongly. On the development side, tests are carried out on heating elements for cookers and washing machines. Of special interest is the section set up to study the efficiency of differing washing actions with varying detergents and hard and soft water.



One of the technicians connects electronic recording apparatus and indicators linked to the test rooms in the refrigerator laboratory

Above, a view of the home laundry laboratory in which Hotpoint washers undergo stringent and exhaustive testing to ensure their efficiency and stability. Illustration shows ultra heavy loads being put on washers by operating tub and power wringer simultaneously



Temperature and humidity conditions simulated to correspond with any part of the world are created in the group of test rooms shown right. Electronic apparatus used to create tropical temperatures and varying degrees of humidity can be seen at the top of the illustration. Readings on the performance of refrigerators during tests can be taken outside each test room

new products and appliances

Semiconductor developments cut prices

SIGNIFICANT price reductions have been made to the entire range of semiconductors manufactured by Texas Instruments. Effective since 1 June, the new prices are said to have been made possible by a rapidly expanding market for semiconductor devices coupled with the introduction of automatic methods of production and testing. Examples of reductions are: "Moly-G" diodes, reduced from 17s to 11s each; type "2S017" silicon diffused medium power transistors, from 110s to 91s 8d; type "2G101" germanium mesa transistors, from 25s to 15s 6d.

Concurrent with price reductions the company have introduced a new high speed silicon switching transistor, the type "2S131," manufactured by the epitaxial process. The technique is said to enable high speed production of quality transistors with reproducible characteristics. Special features of the "2S131" are an exceptionally low collector capacitance and saturation resistance, the latter being virtually independent of temperature over the range −65°C to 175°C. The device has turn-on and turn-off times of, respectively, 8 nanosec and 25 nanosec and a maximum continuous collector current rating of 200 mA. *Texas Instruments Ltd., Manton La, Bedford.*

Battery-driven platform truck

FEATURE of a new two-ton battery electric truck is a hydraulically actuated elevating platform having push-button control. By this means platform heights can be varied from between 1 ft 7 in. and 4 ft 1 in. Powered by a 2·3 h.p. series wound motor with a one-hour rating, the drive incorporates a safety device which prevents it being switched on during platform lifting operations. Running costs are said to be in the region of 10d/day. Fitted with Lockheed hydraulic brakes, the truck has 8 ft 2½ in. turning radius, platform dimensions being 5 ft 6 in. by 3 ft 6 in. *Brush Electrical Engineering Co. Ltd., Loughborough, Leics.*

Stylish lighting fittings from Canada

A RANGE of stylish lighting fittings from Canada is being imported to this country by Mallinson Brothers. They are made by the Montreal firm of Lumiray Mfg. Inc., and come in a variety of shapes and sizes from standard lamps to desk models and novel illuminated ashtrays. Of unusual design are those intended to divide rooms. They are in the form of latticed and contemporary screens with inset fittings of from two to six lamps. Diversity of design is evident in the floor-standing models, which are in a wide variety of shapes and sizes. There are also topical designs in the range for children's nurseries. *Mallinson Bros. Ltd., Waterdale Wks, Mere Clough, Prestwich.*

Decorative ceiling panel

DECORATIVE ceiling panels designed primarily for use in showrooms are now being marketed by Knightshades under the name of "Knight-sky." These translucent panels are constructed of a film of non-sag plastics stretched and secured to a lightweight metal frame. They can be supplied in a variety of simple shapes up to 10 sq ft. Among their uses are said to be incorporation in existing ceilings or use in the make-up of ceiling illumination. These panels allow natural and artificial light to pass through in a diffused glow, eliminating glare. *Knightshades Ltd., Theaklen Dr, St. Leonards.*

Counter for vending machines

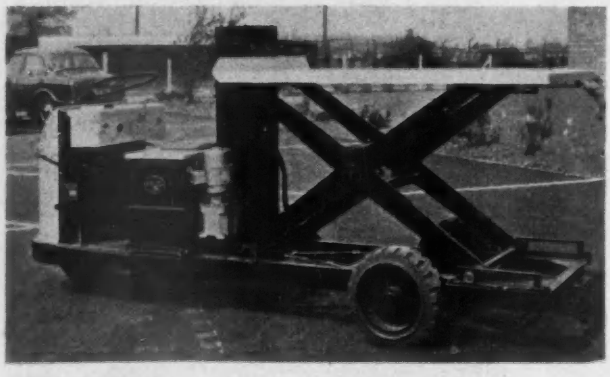
A LIGHT-DUTY electro-magnetic counter by Counting Instruments is designed mainly for use in automatic vending machines. It is a three-digit model with manual preset which enables the counter to be set to a predetermined number. A cut-out device is arranged so that the unit can be preset in a range between zero and 999. Models are available on standard a.c. and d.c. voltages and cost £4 10s. *Counting Instruments Ltd., 5 Elstree Way, Boreham Wood, Herts.*

Liquid level controller

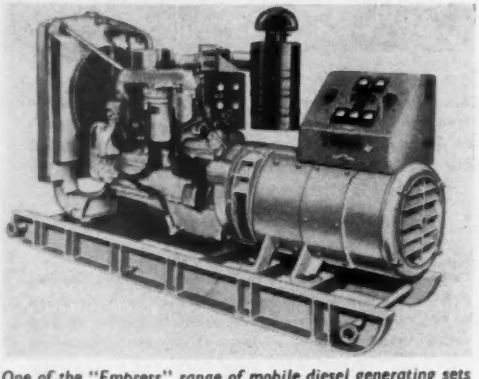
A NEW range of "Lectralevel" floatless liquid level control units is announced. Level is detected by the passage of a small alternating current between two electrodes immersed in the liquid surface. This signal actuates a series of electromagnetic relays whose output is made to operate a solenoid valve or other control device. Several models are available to suit liquids of different conductivity. *Londex Ltd., Anerley Wks, S.E.20.*

Mobile generating plant

IN co-operation with Cummins Engines Ltd., of Glasgow, Dale Electric Ltd. announce the introduction of their new "Empress" range of mobile generating equipment. Powered by Cummins diesel engines, these sets are designed to meet a wide range of customer requirements both for permanent and standby power supplies. The range covers outputs from 68 kVA to 212 kVA, three-phase, 50 c/s or 60 c/s, at any specified international standard voltage; single-phase output can be supplied to special order. Plant is available equipped either for mains failure or push-button electric starting, with control panel plant-mounted or housed in a free-standing cubicle. In addition to supplying generating sets, the same company specialise in the manufacture of trailers for its transport. An example of the type of vehicle available has a six-wheeled steerable chassis with independent suspension, with canopy shelter provided for the plant operator. *Dale Electric (Yorkshire) Ltd., Electricity Bldgs, Filey, Yorks.*



Platform elevating battery electric truck by Brush Electrical Engineering Co.



One of the "Empress" range of mobile diesel generating sets by Dale Electric

Automatic hothouse ventilator

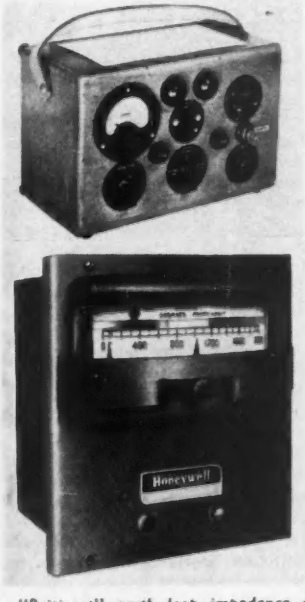
PROMPT operation of greenhouse ventilators in response to temperature fluctuations is a problem claimed to have been solved by Findlay Irvine, by introducing the "Autovent." This device incorporates a thermostat and a geared motor which is said to raise or lower ventilators in 20 seconds. A control dial on the front can be set for automatic control of up to ten fanlights by means of 50 ft terylene cord attached to a spindle. For use on standard voltages, the "Autovent" is loaded to 60 W. It costs £24. *Findlay Irvine Ltd., Bog Rd, Penicuick, nr. Edinburgh.*

Stepless power control

TO initiate stepless control of electrical loads via a magnetic amplifier and saturable core reactor, a recently introduced instrument, the "Pyr-O-Volt," produces a current output directly proportional to a given voltage input. The voltage input, which in the case of furnace control applications could be derived from a thermocouple, is registered on an incorporated millivolt scale. The scale incorporates a second pointer which is the means of presetting the voltage input to current output ratio for a particular control function. The device can produce continuous current output in the range 3 mA to 7 mA, fed to a magnetic amplifier impedance of 4,000 ohms, and will control saturable core reactors having outputs up to 100 kVA. *Honeywell Controls Ltd., Greenford, Middx.*

Loop impedance and continuity tester

DESIGNED for earth loop impedance and continuity testing of wiring installations as laid down in IEE Regulations, the latest version of "Briticent" tester can provide a loop test current of up to 25 A, this being the maximum specified. It comprises a double-wound mains transformer and a direct reading ohmmeter housed in a polished wooden cabinet. Mounted on the front panel are a 15 A, three-pin test socket, selector switches and gas discharge warning lamps. A function of the latter is to give rapid visual indication of approximate loop impedance, determined by the degree of lamp brightness. Weighing only 10 lb, with dimensions 11½ in. by 7½ in. by 7½ in., other applications of the instrument include indication of neutral open circuit, line-neutral reversal and detection of incorrectly wired electric appliances. *British Central Electrical Co. Ltd., 6-8 Rosebery Ave, E.C.1.*



Top, "Briticent" earth loop impedance and continuity tester. Bottom, the "Pyr-O-Volt" instrument for stepless power control

Remote shaft position indicator

FOR giving precise indication of degree of angular rotation of a remote shaft, a range of "shaft position encoders" is now available in this country. Manufactured by the United Aircraft Corporation of America, the shaft encoder generates a series of coded pulses proportional in number to the degree of shaft rotation. Types available differ according to the number of counts/rotation and the code adopted. Thus, the "Type ADC-36BCD" gives 360 counts/rotation with a binary coded output. A second type gives a resolution of 1,000 counts/rotation. One of the many applications of the device is in machine tool control. *Ketay Ltd., Eddes Hse, Eastern Ave West, Romford, Essex.*

Portable cutting and bending tools

AMONG tools available for general installation and workshop use, recent introductions include an improved type of cutter for "Dexion" slotted structural angle and the addition of a copper tube bender to the "Staffa" range of equipment. The "Dexion" cutter, designated the "Mark V," has a guillotine action and is said to simplify cutting at a diagonal. It is readily portable. Price of the cutter is £8 10s.

The new "Staffa Rotabend C/1" is a compact unit incorporating an hydraulic hand pump capable of cold bending unloaded copper tube through up to 180° without distortion. Bending pressure is applied at three points, the pump being preset to achieve the required angle of bend. Supplied with a range of standard formers for handling tube diameters in the range ¼ in. to 2 in., price of the equipment complete is £67 15s.

Dexion Ltd., Maygrove Rd, N.W.6.
Chamberlain Industries Ltd., Staffa Wks, Argall Ave, E.10.

"Staffa Rotabend" handles copper tube

Above, crimped contact plug and socket by Aircraft-Marine Products. Left, Ketay shaft position encoder

Crimped plugs and sockets

CRIMPED connections to contacts is a feature of a new range of multiway moulded plug and socket connectors. The contacts, which have a gold/nickel finish, are designed for either automatic or hand tool crimping to wiring ends; crimping rates of up to 1,000 connections/hr are said to be possible using an automatic machine. Once crimped, each contact can be easily snapped into position on the plug or socket housing. Contacts can be readily extracted to facilitate subsequent rearrangement of connections. *Aircraft-Marine Products (GB) Ltd., 87-89 Saffron Hill, W.C.1.*

Automatic test equipment

ENABLING manufacturers to build up, on a stage by stage basis, complete automatic testing facilities for complex circuitry, the "Score" range of test units has been announced. Nucleus of this equipment is a unit which performs continuity testing in automatic sequence for up to 200 circuit outlets. Location of faults are displayed according to numerical sequence and noted by the operator as they are detected or else printed on a chart recorder. Other units available check insulation resistance (line to earth or to any other line) and other circuit constants. Sequence of tests can be co-ordinated by means of a magnetic tape programming unit. *Elliott Brothers (London) Ltd, Autotest Division, Airport Wks, Rochester, Kent.*

Guillotine cutter for "Dexion" angle

Floor-heating Popular in Flats

ELECTRIC floor-warming for local authority flats receives strong support in a report based on a Building Research Station study. In a digest of the report, published* by HMSO, the relatively high acceptability of electric floor-warming attracts comment, and cost figures show it to be one of the cheapest of systems from the capital cost aspect and the cheapest of all in total annual cost of capital charges and maintenance.

The report is based on a study of some 1,100 flats and maisonnettes on 21 different estates. Water heating as well as space heating was taken into consideration and the work in the investigation was begun four years ago. Most of the flats had two bedrooms, some one and some three. The full DSIR report, now being printed, will cover the range of types of flat. The digest deals only with the average for all flats. Table 1 shows cost figures and Table 2 annual expenditure in cost to the tenant and a measure of tenant satisfaction.

Table 1. Installation, Maintenance and Replacement Costs

System	Capital cost	Equivalent annual cost	Estimated annual cost		Estimated total annual cost
			Maintenance	Replacement	
	£	£ s	£ s	£ s	£ s
CH*, bulk calorifier ...	250	12 10	2 4	2 8	17 2
indiv. calorifier ...	260	13 0	2 4	2 8	17 12
Openable stove ...	184	9 4	5	2 3	11 12
Open fire	161	8 1	5	2 0	10 6
Floor-warming ...	105	5 5	—	2 18†	8 3
Gas fire	132	6 12	1 5	2 12	10 9
Electric fires	91	4 11	1 5	2 12	8 8

* CH = central heating by hot water. † Assuming 30 year cable life.

Table 2. Tenant Satisfaction and Annual Expenditure

System	Cost to tenant*	"General satisfaction" %	"Would not change" %	"Good value" %	"Satisfied with water heating" %
CH, bulk calorifier ...					100
indiv. calorifier ...	£49† (£50)	81	68	78	91
Openable stove ...	£36 (£37)	90	69	94	97
Open fire	£41 (£42)	84	64	89	93
Floor-warming:					
tenant control ...	£34 (£39)	85	76	79	99
landlord control ...	£55‡ (£57)	39	60	29	96
Gas fire	£38 (£42)	58	26	59	88
Electric fires	£40 (£39)	76	56	62	76

* The figures in brackets are the average expenditures in two-bedroom flats. † Including £32 paid to landlord for central heating service. ‡ Including £26 paid to landlord for electric floor-warming.

Temperatures and Fuels

In the investigations, close attention was given to the temperatures maintained by various forms of heating. Central heating systems in general maintained exceptionally high temperatures, even in nominally unheated rooms. Rooms with gas and electric heating under control of the tenant had lower temperatures, but still above those commonly found in houses. Rather higher temperatures were found in electrical floor-warming installations under control of the landlord. For electric floor-warming with tenant control, mean temperatures in living rooms were 62°F, and in the bedrooms 56°F, while for floor-warming with landlord control, corresponding figures are 65°F and 57°F.

Commenting on annual fuel consumption the report notes the comparatively high consumption of solid fuel in central heating systems. For electric floor-warming there was a significant difference between heat inputs where the landlord had control (11,100 kWh) and where the tenant had control (8,060 kWh). Lowest heat inputs and indeed lowest temperatures came from schemes with gas fires and electric fires.

Tenant Satisfaction

The report remarks that degree of satisfaction for individual electric fires is rather lower than that of other forms of heating and lowest of all with electric floor-warming under landlord control. The latter figure seems to be related to the method of thermostatic control used in a particular block of flats. There was a wide desire on the part of tenants with gas fires to change to some other form of heating. Floor-warming under landlord control was more popular than this, but there is dissatisfaction about value for money. It is notable that electric floor-warming under tenant control rates as the system tenants would least like to change.

So far as water heating is concerned, comparatively little variation in satisfaction was found. However, systems using individual gas or electric appliances were criticised on grounds of expense.

The Building Research Station notes in conclusions to the digest that, better methods of control are now being installed in cases where electric floor-warming is being provided by the landlord. The evidence of the investigations, however, confirms the view that at present it is preferable for the tenant to have control of his own heating and to have consumption recorded by individual meters. This arrangement does not necessarily exclude the provision of some fixed background heating with the tenant metered only for supplementary heating.

* *Building Research Station Digest No. 11: Heating in Local Authority Flats. HMSO, 4d.*

INDUSTRIAL TRAINING LAGS EDUCATION

IT was all too evident that educational plans for schools and technical colleges were not being matched by plans within much of industry for the practical training of young recruits. This was said by Sir Willis Jackson, F.R.S., in presenting the 1961 Viscount Nuffield Paper, "Some Human Aspects of Engineering Progress," to the Institution of Production Engineers this week. The seriousness of the situation could be judged, he said, by the fact that from 1957-59 the number of boys entering the engineering, shipbuilding and electrical industries for craft training and apprenticeships had fallen by about 20%. Although the overall industrial intake had risen over the same period by about 4%, this represented a quite inadequate response to the appeals made to industry to cater for the school-leaving bulge.

Earlier in his address, Sir Willis Jackson expressed concern at whether much of what was called a craft apprenticeship was worthy of the description. He spoke of the need for radical reconsideration of the traditional concepts of apprenticeships. He was convinced, he said, that apprentice training, at least at the age of 18, should be treated nationally as an integral part of further education.

Too little recognition had been given to the fact that new ideas developed in the laboratory or design office could not be translated to large-scale production without the supporting skill of large numbers of technicians, craftsmen and operatives, and that the satisfactory training of these was just as vital to industry as the training of scientists and technologists. Shortage of professional people was aggravated by their performing duties which could be undertaken by staff of lower academic qualifications. Such devolution had not been taking place either as extensively or as rapidly as was desirable. In the training of technicians it had long been evident that craft courses gave inadequate technical knowledge. One of the objects of new courses outlined in the Government White Paper was to permit a process of selection upwards into the National Certificate course on success; rather than downwards into a technical or craft course on failure—which had led all too often to selection of no course at all.

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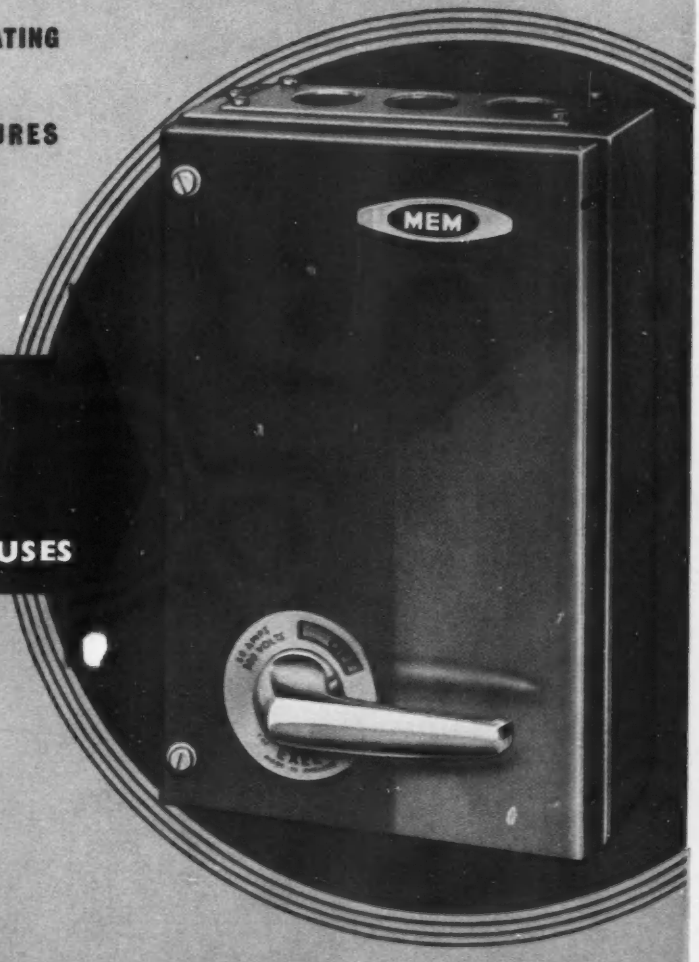

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- Fuse bases are of the new "Kantark-Exel" pattern, which will accept semi-enclosed rewirable or H.R.C. cartridge fuse carriers.
- M.E.M. H.R.C. cartridge fuse carriers are designed to accommodate H.R.C. cartridge fuse-links to B.S.88:1952, Appendix 'J' Dimensions, Form A—Offset Tags.
- M.E.M. H.R.C. cartridge fuse-links are available for use with this range of switchgear, and have been A.S.T.A. certified for Category of Duty 440 AC3 (16,500 amps), 440 AC4 (33,000 amps) and 440 AC5 (46,000 amps).
- "Exel" switches comply with the relevant Temperature Rise, and Making and Breaking Capacity Tests of B.S.861: Part 1, 1955, and switchfuses with B.S.2510:1954.

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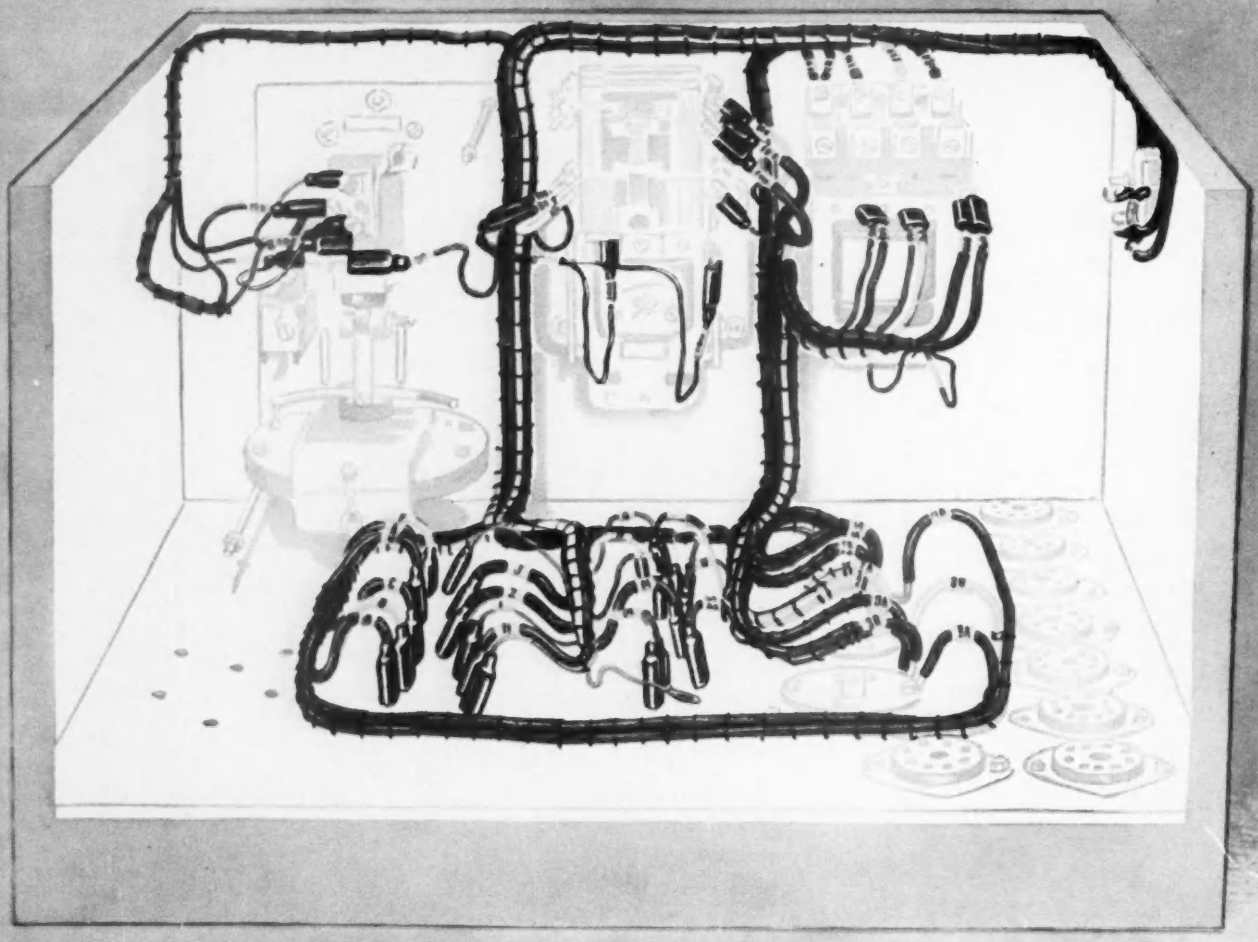

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News of the Week

N.F.E.A. price agreement vetoed

Ruling by Restrictive Practices Court

YET another agreement in the electrical industry has been vetoed by the Restrictive Practices Court. This is the agreement of contracting work charges of the National Federated Electrical Association. A consent order was formally made by the Court on Monday last. At the same time, the agreement of the British Radio Equipment Manufacturers' Association was also declared to be against the public interest, although in this case one or two minor restrictions are being allowed to stand over and there is a possibility that the Board of Trade might deal with these.

The NFEA agreement now outlawed has been in operation for many years. There is a recommended standard form of percentages to be added to labour costs and materials supplied in electrical contracting work.

The RP Court were told on Monday that the NFEA had notified the Registrar that it proposed to discontinue price restrictions. Some of the restrictions were declared contrary to public interest. Some stood over for consideration.

In the case of the BREMA agreement this was considered as divided into two sections. The Association had terminated its agreement in respect of the major restrictions, and the Court agreed that the minor ones should stand over for the time being.

Appliance sales still slack

SALES of major appliances are still some way below the normal judged by the returns of electricity boards for the month of April, set out below. In this, although cooker sales were 3·4% up for the month, they were over 4,000 lower than in March. But installation of immersion heaters is being maintained at a good steady rate.

Washing machine sales, however, 28·6% down, were also considerably smaller than in March. But for refrigerators, the total of 10,601 is nearly 800 up on that of the previous month, although well down on a year ago.

It must be remembered that these sales by area boards represent only a part of the total sales throughout the country.

Appliance sales by area boards	Sales in month ended 30 April, 1961		Sales in 12 months ended 30 April, 1961	
	Total	% change over corresponding period of 1960	Total	% change over previous 12 months
Cookers ...	27,941	+ 3·4	340,902	− 0·9
Water Heaters:				
Immersion	19,078	+13·9	201,846	+ 4·8
Storage ...	5,589	− 9·8	64,854	− 1·2
Washboilers	4,291	− 3·3	55,000	−14·0
Washing Machines ...	7,907	−28·6	98,389	−37·5
Refrigerators	10,601	−32·3	137,403	−20·3
Clothes Dryers ...	1,823	− 7·6	52,340	not avail.

Nuclear commissioning

COMMISSIONING date for both the Berkeley and Bradwell nuclear power stations of the CEGB is likely to be in November/December next. Work on both stations is now running almost parallel, we understand.

At Bradwell, the process of loading of the uranium fuel and checking the reactor is expected to start in mid-July, but a great deal of test work lies ahead. An emergency plan has already been approved to be put in hand in the unlikely event of any untoward happening.

PROMOTING EXPORTS

WITH the aim of expanding and developing overseas sales of refrigeration controls, industrial equipment and other control plant, the Teddington Group have formed a new company under the title of Teddington Controls (Export) Ltd. Managing director is Mr E. Burman, who has been associated with the Teddington group for nearly 30 years, and sales manager is Mr L. E. Bayliss.

Magnet House coming down

THE wind of change is blowing down London's Kingsway. The Stoll Opera House has gone and now Magnet Hse, the GEC headquarters, is to be demolished. Magnet Hse is to be redeveloped "in keeping with present-day requirements" the company state, but no decision has yet been made on the size of the building to take its place, and there is even uncertainty as to whether GEC will occupy a place in the new block. But the company will definitely have a central headquarters in London. Magnet Hse, although started before the first world war as headquarters for GEC, was not completed until late in 1920. Part of the 40,000 sq ft site is freehold and part leasehold.

Hiring plan seeks to evade R.P.M.

GRANDWAYS, the Leeds discount store, have hit back in the resale price maintenance battle with a hiring agreement which involves payments of 1d a quarter over 21 years "if demanded." The down payment is the cut price for the appliance. Grandways are believed to have started offering the scheme, and a test case in court is likely to develop. Electrolux, who last month obtained an undertaking from Grandways not to sell below their fixed prices, are watching the situation closely and are one of the firms likely to seek an injunction. An injunction against price cutting by Grandways has already been obtained by Frigidaire, but this concerns sale and the discount house hope that their hiring plan will avoid it.

In the meantime, local action is mainly concerned with tracking Grandways' sources of supply. These are thought to be mainly wholesalers keen to dispose of out-of-date models.

E.L.F.A. defines quality fluorescent fittings

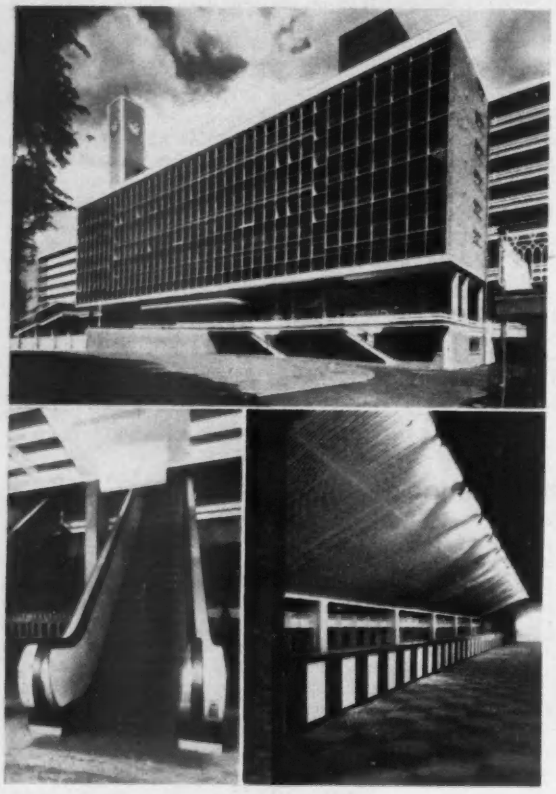
SURFACE finish as a factor determining long-term efficiency and life of industrial fluorescent fittings receives particular attention in a new specification just published by the Electric Light Fittings Association. The specification has been drawn up to assist works engineers and other concerned with purchase to assess "quality" of fittings with respect to their future serviceability in industrial environments. It refers specifically to stove- and vitreous-enamelled fittings and sets out a comprehensive range of tests to define certain minimum requirements for enamel finish. These include degree of surface hardness and resistance to abrasion and effect of impact. In addition, the finish must possess an optical reflection factor of at least 80% and be resistant to attack from specified corrosive agents.

Intended as a guide to quality of complete fittings, the ELFA specification embodies existing BS concerning performance of individual components and safety requirements. It supplements the BS by specifying maximum temperature rise of components when mounted in the fitting. Final clauses of the specification deal with cut-off angle subtended by louvres, concluding with general notes on the appraisal of photometric performance of fittings. In announcing the new specification, the Association stress that compliance by ELFA members is not obligatory.

A WINNER AT ASCOT

FLOOR-WARMING has scored one of its best wins at Ascot, where 1,047 kW of Falk, Stadelmann's Florawarm has been embedded in all main floors of the Queen Elizabeth II grandstand. The stand, finished in time for Royal Ascot this week, may also be used for winter hunt meetings, and this prompted the Trustees to provide heating. Nearly 42 miles of direct-embedded cable with thermostats were installed below the 280 private boxes, seven bars and two totalisator halls by Bective Electrical Co.

Other electrical features are ten hoists to raise food from the basement to serveries on the five private box levels, and a Belling boiling plate in each of the boxes. Otis supplied four 40 ft escalators which take racegoers to the mezzanine floor and six lifts serving the upper floors.



Top, entrance to the stand. Bottom, left, one of the escalators; right, the Pall Mall bar

MORE HEATING OF ROADS

QUICKLY emerging from the purely experimental stage, electrical warming of roads to prevent frost and ice has now advanced to full recognition, we judge.

At the annual conference of the Institute of Public Cleansing, at Aberdeen last week, Mr P. D. Fairlie, of Glasgow, advocated such installations in arterial and ring roads particularly liable to frost and snow hazards. In his view the development of such roads had placed increased responsibilities on the local authorities to keep them safe. There had been a great advance in the use of modern snow ploughs, gritting machines, etc., but even with the best possible organisation, difficult conditions could be created by a sudden snowfall or severe frost. With the continuing increase in road traffic it was essential that greater thought should be given to road safety in all weather conditions. Electrical warming of road surfaces in various parts of the country had been carried out successfully and he urged the more widespread provision of such equipment. Costs were, of course, the influencing factor, but they should be measured against the annual cost incurred by local authorities in keeping these roads safe and the dislocation which could occur to industry and commerce, apart from the danger to human life, he stressed.

Whitworth Foundation Scheme

PRACTISING engineers who wish to follow a course of training, study or research at postgraduate level are being offered three Whitworth Fellowships for 1962 by the Ministry of Education. The awards are worth £1,000 a year, plus additions for dependants, travelling and subsistence where appropriate. In addition, three Whitworth Exhibitions of £100 will be awarded to unsuccessful candidates whose work deserves recognition. Applicants must be over 25 and possess a University degree in engineering, a Dip.Tech., or H.N. Diploma or Certificate. Application forms are obtainable from the Ministry (FE3C), London, W.1, to whom applications must be returned by 31 July.

LEAVE TRADING TO DEALERS?

ELECTRICITY and gas boards should concentrate on selling their fuels and leave the trading in appliances to the merchants, be they builders' merchants, or appliance retailers. That was the view expressed by Mr K. J. Fisher, president, opening the first conference of the National Federation of Builders' and Plumbers' Merchants, at Torquay last week.

When the gas industry was nationalised the new authority virtually grabbed the gas-appliance trade, he said. Now they were suffering from it and wanted the distributing field widened very considerably. The electricity authority did not, and were not allowed to make the same mistake. If it were possible to see the results of boards' trading in appliances with the proper overheads allocated, he suspected they would make very sorry reading in many cases.

OFFICIAL PUBLICATIONS

Heating in Local Authority Flats. Building Research Station Digest No. 11 (second series). HMSO, 4d.

A Domestic Heating Survey of England and Wales. Utilisation Research Report No. 18. Electricity Council (see page 972).

ELFA Quality Specification for Industrial Fluorescent Fittings, No. 1/1961. Electric Light Fittings Association, 1s 6d (see page 973).

BS 2133B. Fixed Ceramic Dielectric Capacitors, Grade II, for use in Telecommunication and Allied Electronic Equipment. Part 1. General requirements and tests. 12s 6d.

BS 2136. Fixed Metallised-paper Dielectric Capacitors for d.c. operation for use in Telecommunication and Allied Electronic Equipment. Part 1. General requirements and tests. 12s 6d.

BS 3383. Normal Equal-Loudness Contours for Pure Tones and Normal Threshold of Hearing under Free-field Listening Conditions. 4s 6d.

BS G178. Crimped Joints (non-insulated) for General Purpose Electrical Cables for Aircraft. 6s.

BS 448. Electronic Valve Bases, Caps and Holders. Sections B8D/3 and 7/3. 3s each.

BS 3456. Testing and Approval of Domestic Electrical Appliances. Section A5, electric toasters; A6, coffee percolators; A7, washboilers (4s 6d each); dry shavers (4s).

MORE EXPORTS TO POLAND

EXPORTS of electrical goods to Poland are expected to total around £1 million in the coming 12 months, slightly higher than in the past year. Under a renewed trade agreement taking effect on 1 July, UK exports to Poland are expected to be £8 million higher at £24 million, and imports from Poland, mainly food, £1 million higher at £39 million. Details of quotas are expected to be announced in this week's Board of Trade Journal.

Who rigged the E.T.U. election?

THE theory that the 1959 election of Mr F. Haxell, as general secretary of the ETU, "was rigged by Mr L. Cannon and those people associated with him throughout the country" was put forward by Mr F. Foulkes, president, in concluding the evidence in the High Court action in which Mr J. T. Byrne and Mr F. Chapple are claiming damages for conspiracy.

Earlier, in reply to Mr Justice Winn, Mr Foulkes said he thought the executive council had no alternative but to accept the scrutineers' report. And when he read out Rule 21(70) as giving a branch the right of appeal, the judge commented that "the executive council cannot set aside a disqualification and decide that the vote shall be accepted. Is that not obvious to a child, let alone a man of your experience in union affairs?"

During his 6¼ hours in the witness box Mr Foulkes was involved in several sharp exchanges.

Denying that he had been party to a conspiracy to rig the election of Mr Haxell, he said he had never attended any meeting of Communist Party members who met to issue their instructions to union leaders. His first duty was to members of the union.

Earlier, Mr R. G. MacLennan, acting assistant general secretary of the Electrical Trades Union, agreed that the December, 1959, election was void because of the fact that branches were receiving more ballot papers than they were entitled to have. Asked by Mr Justice Winn if there was no other reason why he and the other defendants decided to yield on that issue, Mr MacLennan replied "No."

Questioned by counsel about branch secretaries and chairmen going to head office to check the envelopes, he said he was convinced that the envelopes received by head office were those he produced to the branch officials.

Referring to the form the latter were asked to sign after being shown the envelopes, His Lordship asked Mr MacLennan if he intended them to acknowledge the envelope they had seen was the one in which their ballot returns had been posted? The reply was, "Yes, that was the only basis for asking them to sign the form." His Lordship then said he had previously supposed defendant's position to be that the wording of the form was possibly ambiguous, but that it was a harmless and innocent record of the fact that an envelope had been shown. If, as witnesses had said, they were asked to sign the form on the understanding that it meant only that they had examined an envelope, that would be a fraudulent trick. Mr MacLennan agreed that it would.

'Fridge sales disappointing

EXPORTS of domestic refrigerators fell in April for the first time in months, and home demand at this stage in the main selling season also proved disappointing. Manufacturers' deliveries to the home market totalled 103,019, which was 14% lower than the previous April, whereas March's deliveries of 95,217 were only 7·8% below March, 1960. Repeat orders from retailers have not been forthcoming in the expected volume, despite the good weather. At present only 22% of the homes in this country have refrigerators, compared with 97% in the US, the Domestic Refrigeration Development Committee points out.

Reversing the previous trend, exports in April were fully 17% lower than a year ago. Exports of 12,232 in April this year also show a poor comparison with 13,544 in March, but taking the first four months of 1961 as a whole, exports are still 11% higher than a year ago.

EIRE'S EXPANSION PROGRAMME

IN addition to two new peat-fired power stations now under construction at Bellacorick and Shannonbridge, the Eire Electricity Supply Board is to extend several of its existing stations in a development programme covering 1962-66. The largest of these additions will be two 60 MW generating sets at the Ringsend steam power station, Dublin. At the Marina station, Cork, which now has two 30 MW sets, one 60 MW machine is to be added. The milled peat-fired station at Ferbane will have another 30 MW set, and the capacity of the Rhode station will be doubled to 80 MW. Additional units are also to be installed at Portarlington and in the North Wall station, Dublin.

Margins lower under R.P.M.

A CRUCIAL point was gained by Mr Frank Friday in the debate on Resale Price Maintenance at Birmingham last week when his contention that RPM margins are lower than on free-priced goods was admitted by Mr Ralph Harris, who was speaking for abolition. Conceding the point, Mr Harris said that it was only possible because "branded goods go through the shops quicker." The diversity of retailing standards and service, and of customers, was Mr Harris's main argument.

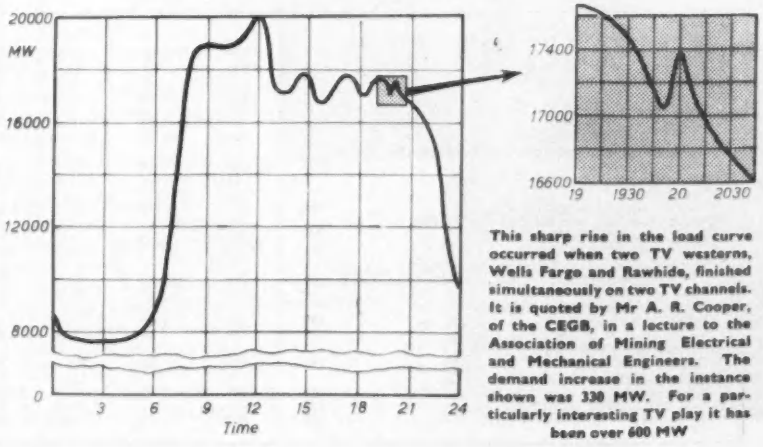
EUK takeover deal

THE business of EUK Catering Machinery Ltd. has been acquired by Moorwood-Vulcan Ltd., the Anglo-American company formed last February by Moorwoods Ltd., of Sheffield, and the Vulcan Hart Corpn., of America. Mr T. Firth, chairman of Moorwood-Vulcan, and Mr R. I. Slater, managing director of that concern, join the board of EUK.

Support for Hydro Board

UNANIMOUS support for the continued independence of the North of Scotland Hydro-Electric Board was voiced by representatives of the Highland County Councils, together with several members from Perthshire County Council, at a meeting in Inverness last Friday. They met to consider what evidence they should give to the Departmental Committee set up by the Secretary of State for Scotland, which is to investigate the generation and distribution of electricity in Scotland. It was agreed that the Hydro Board should continue without any impairment of its powers to generate and supply electricity and to assist in carrying out any measure for the economic and social improvement of the North of Scotland. A memorandum of evidence is to be submitted to the Departmental Committee.

LOAD EFFECTS OF TV



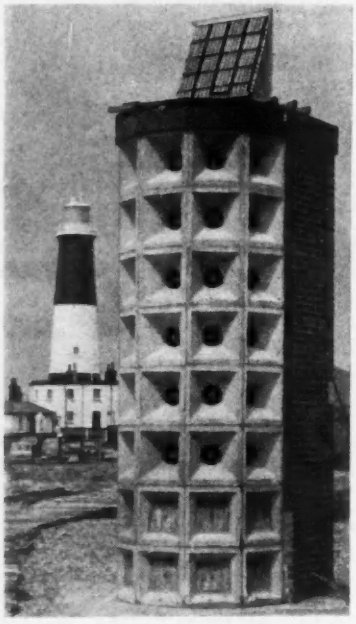
This sharp rise in the load curve occurred when two TV westerns, Wells Fargo and Rawhide, finished simultaneously on two TV channels. It is quoted by Mr A. R. Cooper, of the CEGB, in a lecture to the Association of Mining Electrical and Mechanical Engineers. The demand increase in the instance shown was 330 MW. For a particularly interesting TV play it has been over 600 MW

G.E. THREATENED

THE US Justice Department have further clouded the price-ring issue by threatening to break up American General Electric into smaller units unless the company agrees to avoid selling at "unreasonably low prices." GE have objected to this provision in a document agreeing to refrain from price-fixing in future, which the defendants in the case have been asked to sign. The company contends that the condition is unworkable and getting near to the position which resulted to the trust-busting action in the first place.

Solar Cells for Sea Lights

SOLAR cells are likely to replace gas systems for lighting marine buoys in the next few years. The cells, used in conjunction with rechargeable batteries, could provide sufficient power to operate a low power filament lamp or a Xenon flash tube operating in conjunction with a transistorised flash coder for identification. The experimental station of Trinity Hse, at Dungeness, has installed a group of 400 cells, connected in series-parallel, which is being used to charge ten 1·2 V Nife storage cells. Ferranti cells are used in the installation, each cell providing about 0·4 V on load. The cells can be used with a temperature range of −40°C to 125°C and achieve a conversion efficiency of between 6% and 10% of light energy supplied. The installation shown is intended for estuary navigation lights. The next development stage will be to construct a buoy with the cells arranged to give sufficient power to charge a 45 Ah battery mounted inside the buoy.



A group of 400 Ferranti solar cells in this experimental installation at Trinity Hse, Dungeness, are being used to charge 10 Nife storage cells

ROMAN WALL AND MOD. CONS. IN GLOUCESTER SERVICE CENTRE

PART of the old Roman wall that surrounded Gloucester has been preserved in the basement of MEB's latest and largest service centre. And at the opening in King's Sq last week, Mr W. S. Lewis, MEB chairman, said the Romans would have approved of the floor-warming in the new building, because it was based on the same principle as their own central heating, with the electric cables taking the place of hot air ducts. Unlike the normal Roman system, however, the floor-warming is installed in each of the three storeys and amounts to 125 kW.

Mr Lewis took the opportunity to correct any misapprehension that the Board's 160 service centres were supported by tariffs. On the contrary, turnover on contracting and sales of apparatus is now running at over £9 million a year, compared with £1·4 million in the Board's first year, and the profit is helping to hold tariffs down.

The opening ceremony was performed by Miss Jean Morton, the Midlands ATV announcer and star, following which a show of spring and summer fashions was staged by Peter Robinson's—the first of four shows to be held in the service centre to celebrate the addition to the amenities of Gloucester. The new showrooms supersede former premises at the corner of Eastgate St and Brunswick Rd, which had become inadequate.

Appliance Exports Up

EXPORTS of domestic appliances rose sharply in the first quarter of this year. Compared with the corresponding period of 1960, automatic and combination washing machines jumped 48%, vacuum cleaners 50%, cookers 30% and refrigerators 25%.

In the home market, space heaters, storage water heaters and immersion heaters continued to move ahead strongly, all with rises around the 30% mark. Of the other major appliances, automatic washing machines were the only ones to do better than a year ago.

Small appliances did well, both at home and overseas. With the exception of the fourth quarter of 1955, home deliveries of toasters were the highest ever recorded at 68,000, worth £212,000, BEAMA's quarterly figures show.

MANUFACTURERS' DELIVERIES OF DOMESTIC ELECTRICAL APPLIANCES FOR JANUARY-MARCH, 1961

	Home			Export			Total		
		Value			Value			Value	
	Number 000's	£000's	% change on 1st quarter of 1960	Number 000's	£000's	% change on 1st quarter of 1960	Number 000's	£000's	% change on 1st quarter of 1960
Domestic Laundering Equipment									
Washing machines with electrically driven agitators:									
(a) with hand or power wringers	61	2,224	− 50	19·6	501·0	+ 19	81	2,725	− 44
(b) spin dryer and automatic types	128	6,856	+ 24	38·6	1,231·3	+ 48	167	8,087	+ 27
Wash boilers (up to 10 gallons)	51	338	+ 8	0·8	4·9	− 18	52	343	+ 8
Spin dryers	32	522	− 19	8·9	115·8	+ 2	41	638	− 16
Heated tumbler dryers	9	280	− 24	0·7	19·4	+ 88	10	299	− 21
Irons: (a) non-automatic	43	31	+ 29	8·2	5·7	− 32	51	37	+ 16
(b) automatic	331	554	− 17	132·5	201·1	+ 16	464	755	− 10
Domestic Cleaning and Polishing Equipment									
Vacuum cleaners	258	3,409	− 22	77·7	614·9	+ 50	336	4,024	− 16
Floor polishers and scrubbers	4·8	66	nil	13·6	113·4	− 7	18	179	− 5
Refrigerators									
Domestic electric refrigerators	164	n.a.	− 30	27·3	n.a.	+ 25	191	n.a.	− 25
Domestic Cooking and Kitchen Equipment									
Cookers: (a) below 5 kW	29	325	+ 4	1·8	13·8	− 22	31	339	+ 2
(b) 5 kW to 12 kW	106	3,778	− 4	4·2	115·3	+ 30	110	3,893	− 3
Food and drink mixers up to 3 quarts capacity, including all hand held	26	291	+ 6	21·5	222·9	− 4	48	514	+ 1
Toasters	68	212	+ 53	22·0	70·8	+ 55	90	283	+ 53
Domestic Water Heating Equipment									
Immersion up to 3 kW	165	270	+ 26	1·7	3·3	− 44	167	273	+ 24
Storage up to 30 gallons	51	553	+ 28	5·4	79·3	+ 46	56	632	+ 30
Domestic Space Heaters									
All types up to 3 kW	740	2,871	+ 30	20·1	69·6	+ 4	760	2,940	+ 29
Personal Appliances									
Electric blankets	134	396	− 33	3·0	10·3	+368	137	406	− 32
Hand hair dryers	118	209	+ 82	31·6	56·6	+ 91	150	266	+ 83
Dry shavers	103	380	− 23	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

Enough Electronics Education?

SOME scientists fear that we are not yet applying sufficient resources to discovering new phenomena and developing new observations for practical ends, despite the great efforts now being made to enlarge training facilities. This opinion was expressed by Sir Howard Florey in proposing the toast of the British Institution of Radio Engineers at their dinner held at the Savoy Hotel last Thursday. He asked whether our young people were given the best possible chance of matching their talents with their capabilities. There was reason, he said, to suppose that the school system was inadequate to feed higher educational establishments with a number of intelligent people. This theme was taken up in his reply by the president, Admiral of the Fleet the Earl Mountbatten of Burma. Earl Mountbatten considered it vital that basic education and vocational training, particularly for the younger generation of radio engineers, should be examined. An ever increasing number of fully trained radio and electronics engineers was needed, he said, but he doubted whether we were keeping pace with the demand. Later in his reply, Earl Mountbatten referred to the importance of reducing production costs and improving reliability of computers. In the field of space communication there was a colossal premium on miniaturisation in terms of £ sterling/pound mass for a satellite. Later this year the first British satellite will be put in orbit; but, already, American radio firms were considering a venture to develop a satellite communication system and meteorological satellites were likely to be an indispensable aid to the future development of high-flying aircraft communication systems. Earl Mountbatten also expressed his belief that, while the fighting services must have their own integral short-range communication links, for long-range world-wide networks it would be much more economical to combine the three separate networks at present operated by the services.

Export Control on Strategic Materials

BY international agreement, the embargo on the export to the Soviet Bloc and China of many types of strategic equipment was lifted a month ago, but now export licensing control has been imposed on a few highly specialised items. The apparatus affected is mainly concerned with electronics and communications and with photographic systems for space vehicles. Licences are required for either all or most countries.

Status Quo for Railway Modernisation

CURRENT projects in British Railway's modernisation programme are unlikely to be curtailed as a result of the recent BTC executive reorganisation. This was affirmed by the new chairman, Dr Richard Beeching, at a press conference this week. He said that projects which had not yet reached the construction stage would, however, be subject to modification to fit in with possible changes affecting the future pattern of the railway system.

What the new pattern was likely to be could not be resolved until a thorough investigation had been carried out into ways and means of remedying the present situation, which was one of mounting losses. Questioned about resumption of the Glasgow suburban electric services, he declined to comment, but we understand the report of the inquiry will be issued shortly.

HALF-CENTURY GAP IN HOTELS STANDARDS BRIDGED IN FIVE HOURS

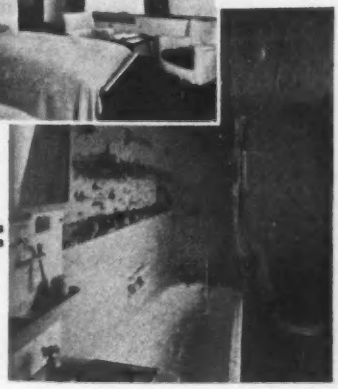
HOW long would it take to convert an hotel bedroom built in 1909 into a luxury suite with private bathroom, thermostatically controlled water-convector heating, TV, radio, telephone and service-call button? The unlikely figure of five hr/suite was achieved at Strand Palace Hotel this spring when 215 rooms were replaced by 181 suites of the best 1961 standard. "Parallel working" was the key, in which the proprietors, J. Lyons and Co., their consultants, and Cubitts the builders, put their heads together and planned all the details before demolition started. The electrical contractors on this high-speed job were J. Lyons's own contract department.

Among the novel space-saving ideas is a console unit by the bed for controlling light switches, radio, telephone and other services. Some rooms are wired for piped TV, while others have the slot type. In the bathroom there is a heated towel rail, shaving cabinets and mirrors with separate strip lighting, and a multipoint electric razor plug.

All electrical circuits were prefabricated on the harness system in Pyrotenax sheathed with p.v.c., so that they were ready for immediate connection to the mains supply. The project included the laying of 54 miles of electric cables and at peak periods there were 56 electricians and mates on the job.

One of the requirements for the planners was that guests on the remainder of the floor should not be disturbed while the particular section was being modernised. Even the chute taking rubble into waiting trucks in Essex St was soundproofed and the trucks themselves were signalled into position by an electric warning system. Lyons plan to start work on the conversion of a further 250 rooms at the end of this year.

Left: A bedroom in the restyled section.



Right: Each suite has a bathroom. This is an example.

OPPORTUNITIES IN WESTERN AUSTRALIA

LOW-COST electricity, recently reduced from 2·05d/unit to 1·8d/unit for units over 50,000 a month, is one of the factors favouring industrialisation in Western Australia, reports a team of industrialists which Mr J. O. Knowles, a director of Metal Industries Ltd., led to that State late last year. Most electrical equipment comes from the eastern States or overseas, but the smaller types of electric motors are already being manufactured and exported to other parts of Australia.

The report says there would appear to be scope for the manufacture of the more popular types of cable. Since then BICC have made plans for a £½ million project. Because of the natural resources and the presence of a large new BP refinery, some of the greatest opportunities relate to the chemical industry.

Channel Cable Laid

THE British section of the twin 100 kV d.c. cross-Channel cable was successfully laid last Friday by the converted CEGB collier, *Dame Caroline Haslett*. The cable, manufactured by AEI and BICC, was scheduled for laying at the end of May, but weather delayed the operation on two or three occasions. Soon after laying, the cable was given a preliminary test and CEGB acceptance tests were scheduled for completion earlier this week. Joining with the French section is scheduled for 21 June.

DENIS FERRANTI LICENCE IN INDIA

DENIS FERRANTI meters are to be made in India under licence as a result of an agreement recently concluded with Seshasayee Brothers (Private) Ltd., of Tiruchirapalli. A factory to be built in India will employ a number of technicians from the Indian company at present being trained in the UK by Denis Ferranti.

STAMP TRY-OUT

EAST MIDLANDS are the latest Board to try prepayment stamps for consumers' bills. An experiment with 2s 6d stamps available from the two Nottingham service centres and also at West Bridgford will begin shortly. At the Carrington St, Nottingham, service centre, a stamp-dispensing machine will be installed.

Absconding Servicemen

COMPLAINTS that the North Western Electricity Board insists on a deposit from servicemen before it will supply electricity to them has been made by an RAF officer to the Preston District Committee to the area Electricity Consultative Council. It has been pointed out that the Board have always adopted that policy, because servicemen are often posted overseas at short notice. Experience has shown that much time, trouble and expenditure is involved in recovering outstanding sums for electricity from such servicemen who have to be traced overseas.

TRADE LESS BUOYANT

RETAIL trade eased in May from the very high level of the two preceding months. Provisional estimates of the BoT indicate that the index of sales fell back one point to 114. Compared with a year earlier, this was up about 3%, but higher prices and the relative positions of Easter and Whitsun in the two years account for much of the difference.

Sayings OF THE WEEK

"Ten years ago the housewife in this country spent about £170 million sterling on domestic appliances: this year she will spend about £470 million—a growth in sales of little less than three times in ten years." . . . LORD CHANDOS, chairman, AEI.

"Our insides are capable of making a great enough variety of noises by themselves without calling in the aid of electronics to increase them." . . . SIR HOWARD FLOREY, at British Institution of Radio Engineers' dinner, referring to internal radio transmitters.

"Electricity is at the very root of the objects for which we are all striving—the elimination of drudgery, the saving of manpower, better health, and an improved standard of living." . . . SIR JOHN PICKLES, BEPC president, in his address.

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Tuesday, June 13

	£ per ton	Weekly change £
COPPER, standard class A (settlement) ...	237½	−1½
" (3 months)	239½	−1½
LEAD, refined pig, 99·97% purity (cash)	64½	−¾
" (3 months)	65½	−½
TIN, refined, min. 99·75% purity (settlement)	880	+2
(3 months)	888½	+7½
ALUMINIUM, ingots 99·99·5% ...	186	—
" wire bars (4×4×54")	193½	—
BRASS Strip 63/37	207½	—
SILVER (Troy oz)	79½d	—

	£ per ton	Weekly change £
ZINC, virgin, min. 98% purity (cash)	78⅞	−2½
" (3 months)...	79⅝	−2⅝
RUBBER, per lb. No. 1, RSS. spot	24⅞d	−⅛d
c.i.f. basis, ports. August ...	24⅝d	−⅛d
ARMOURING: Galv. Steel Wire (0·104 in.) ...	67½	—
Mild Steel Tape (0·04 in.) ...	53*	—
NICKEL (home)	600	—
MERCURY (76 lb flask)	67	—
AMERICAN PRICES: Copper, electrolytic (per lb) ...	31c	—
Lead. (New York)	11c	—

* *Tape Price, now an average, includes varnishing*

LARGE CONTRACTS AWARDED

A £1½ million order for 11 electrostatic precipitators for the West Burton power station has been awarded to Lodge-Cottrell Ltd.

MOTOR control centres for the new Ford Motor Co.'s works at Halewood, Lancs, valued at £132,000, are to be supplied by Brookhirst Igranic Ltd. Cabling of motor, control and distribution circuits from the individual starters will be carried out by Malcolm and Allen, another company in the Metal Industries group. The contracts cover the supply of 60 wall mounting starters and 52 switchboards to control about 500 motors and provide distribution facilities. Starters over 15 h.p. are to be of the auto-transformer type, and those for lesser h.p., of the direct-on-line type. Supplied separately are a number of control push-button stations, switchfuses for oven temperature controllers and a load-breaking isolator for mounting adjacent to each of the individual motors.

FERRANTI Ltd. have received an order from the CEGB for transformers of the highest rating yet ordered by the Board. The contract is for two 400,000 kVA double-wound transformers for Blyth "B" power station to step up the generator voltage to 300 kV and provide direct connection to the supergrid. They will be water-cooled and fitted with Ferranti high-speed resistor transition on-load tap changing.

IT is now revealed that the GEC Applied Electronics Laboratories at Stanmore have been entrusted with the development of the guidance receiver for the Mark 2 Seaslug ship-to-air missile.

WHAT is claimed to be the largest and most powerful h.f. induction melting furnace in the UK has been ordered from GWB Furnaces Ltd. For the North Eastern Iron Refining Co. Ltd., of Stockton-on-Tees, it will be used for the production of specialised refined alloy pig irons and steel. The first furnace body will hold up to 7 ton, but a second may be just over 10 ton capacity. The 1,700 kW h.f. generating plant will work in conjunction with a bank of water-cooled capacitors. A motorised 10,000 A furnace selector switch is also to be supplied.

A £350,000 contract for the whole of the mechanical and electrical services for the new headquarters office now under construction at Walton-on-Thames, for Birds Eye Foods Ltd., has been awarded to Matthew Hall and Co. Ltd. The building will be fully air-conditioned by means of a high velocity induction system.

News in Brief

An autumn illuminations scheme for Barry Island, estimated to cost £1,500, has been approved by the local traders.

BICC have supplied some 65 miles of m.i.c.s. cables to the Midlands Electricity Board for the City of Birmingham's building scheme, which includes the construction of nearly 3,000 flats and dwellings and about 150 shops.

Newcastle Airport Committee have recommended the City Council to install a new high-intensity lighting on the east-west runway of the Municipal Airport at a cost of £8,861.

The Birmingham Electrical Golfing Society's Single Stapleford Competition was won by Mr J. D. Monk, with Mr D. J. Hinton runner-up. The annual match against the London Electrical Industries' Club will take place at Frilford Heath Golf Club on 28 June.

A new hydraulics laboratory at the Kilmarnock works of Glenfield and Kennedy Ltd. was completed last week.

The third 100 MW set at Aberthaw power station was commissioned recently.

The BoT Standing Committee will resume their inquiry on 20 July to consider whether refrigerator cabinets should bear an indication of origination.

Concerned because guarantees sometimes take away shoppers' rights rather than add to them, the Consumers' Advisory Council of BSI is planning an approach to the appliance industry.

On 18 Oct. an exhibition from the Design Centre will be opened at the Svensk Form Exhibition in Stockholm.

OVERSEAS NEWS

from our correspondents abroad

CANADA

Meters Wanted

Because four large Canadian electrical companies quoted an identical price of $104,750 for the supply of 5,000 kWh meters, Calgary's City Council rejected the bids and has asked its purchasing agent, Mr L. R. Webb, to seek other sources of supply. He is now endeavouring to make contact with firms in Britain, Japan, Italy and Switzerland, who could supply the meters, and he has indicated to the City Council that it may be several months before firm tender prices are obtained.

Undergrounding Lines

The problem of putting overhead wires in downtown Ottawa underground has been taken a step further. The Mayor of the City Council last month disclosed that it was planned eventually to ask for federal and provincial financial assistance for a complete removal of the main centre town area of the capital between now and the 1967 Centennial. General manager of the Ottawa Hydro-Electric Commission, Mr F. G. York, has told the City Council that he would recommend to the Commission paying one-third the total cost, estimated at $35,000, for undergrounding the power lines in one area. But it is not only the Hydro Commission's property that would be involved in the complete project, and a move has been made to ascertain the total cost for the whole scheme.

ST. LUCIA

Aid or Takeover?

The need for an improved electricity service in St. Lucia, in the Windward Islands, has been evident locally for some time now. The Minister of Communications and Works, Mr M. Jean-Baptiste, revealed recently that negotiations had been entered into with the Colonial Development Corporation to see if the latter would provide capital for additional plant and take over control of the service.

U.S.A.

More Libby Surveys

Work on the massive Libby Dam on the Kootenay River in northern Montana, held up by lack of agreement with Canada concerning the flooding of land in that country, may soon be commenced. The recent US/Canadian Treaty, just ratified by the Senate, but still awaiting ratification by Canada, in addition to development of the Columbia River also contains enabling authority for construction of the Libby Dam. Anticipating ratification, the US army engineers have already sent in survey teams. The proposed 400 ft high dam will create a 95-mile lake, of which 42 miles will be in Canadian territory. The power station is to have four 86 MW sets initially.

LIBERIA

New H.E. Scheme

A new hydro-electric project is to be constructed in Liberia under a $22 million agreement recently signed by the Liberian National Electric Corporation (a Belgian company) and the Liberian Government. Work is scheduled to begin next month on the project on the Saint Paul River. It is to be completed by the end of 1965. The agreement gives the company the right to generate and distribute electricity in Liberia for 50 years (the Government holds 25% of the company's shares).

CEYLON

Development Loan

The World Bank has just made a loan equivalent to $15 million to Ceylon to add 75 MW of generating capacity and extend power distribution in the western part of the island. The additions will double available capacity in the most populous and industrially active part of the country, and satisfy power demands in the area for the next five years. Projects to be financed by the loan include a 50 MW hydro-electric station at Norton Bridge on the Kehelgamu River, and the installation of a second 25 MW set at the Grand pass thermal power station, near Colombo. This latter plant is urgently needed to avert a power shortage which would otherwise occur before the Norton Bridge station can be put into service in 1964. Completion of the latter station should take care of power requirements until late in 1966. The loan is also to be used in erecting 95 miles of transmission lines from Norton Bridge to Galle, the third largest town in Ceylon, and a further 50-mile section from Bolowatta to Puttalam on the west coast. About 200 miles of l.v. transmission lines and 200 substations will also be built in the area. The projects will be part of the integrated power system operated by the Department of Governmental Electrical Undertakings, which also supplies in bulk to 75 municipal, urban and village communities. Announcing the loan, the World Bank state that in the near future, the Government intends to establish an electricity board which will take over the DGEU's responsibilities. Exactly two years ago we reported that opposition by the local authorities to Ceylon Government's plan to establish a Central Electricity Board was holding up further World Bank funds for development. The formation of such a board was recommended by Mr J. G. Park in a report in 1958.

AUSTRALIA

Tennyson Tenders

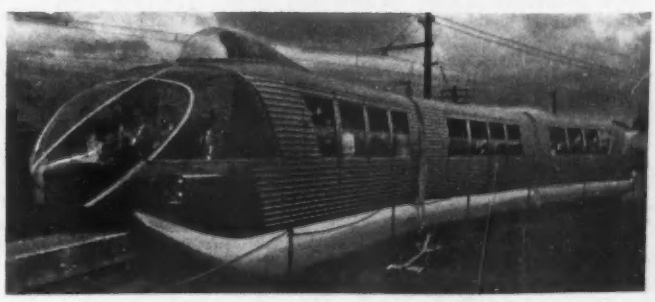
Brisbane City Council have been recommended to accept two tenders totalling £2,004,604 for new plant for the final stage of the Tennyson power station. One tender, of £1,158,389, is by Babcock and Wilcox, of Australia, Pty. Ltd., for the boiler plant, and the other, of £846,215, by Evans Deakin and Co. Ltd., is for the turbo-alternator plant.

Take-over Bid

The British firm of Stone-Platt Industries Ltd. has made a take-over bid for McColl Electric Wks Ltd., of Melbourne. J. Stone and Co. (Australia) Ltd., a subsidiary of the UK company, already owns 113,026 of the 440,000 Ordinary shares of McColl and is the largest shareholder. The Electric Construction Co., also of the UK, holds 40,000 shares. Stone-Platt are offering 12s cash for each 10s Ordinary share or convertible unsecured note.

Hazelwood Switchyard Contract

A £636,000 contract for the complete 230 kV switchyard for the first stage of the new Hazelwood power station of the State Electricity Commission of Victoria has been awarded to Associated Electrical Industries Ltd. The equipment, a great deal of which will be manufactured in Australia, is to be installed by 1964.



Intended for an amusement park, this is Japan's first supported type monorail. Built by Tokyo Shibaura Electric Co., it carries 88 passengers and has a maximum speed of 40 k.p.h.

Company Activities

AFTER the recent battering handed out to the stock market by the batch of warnings, cautions and even pessimism on prospects by a number of the "big guns" of British industry, the forces of recovery were clearly last week doing their best to nudge share prices once more warily forward. There is no doubting the heavy weight of money still available for equity investment and this will shortly be added to when the Trustee Bill becomes law, permitting trustees to invest up to half their funds in Ordinary shares. There is also the point well worth considering that, however high London prices may look, the majority of dividend yields are still way above yields obtainable on Wall Street and on Continental bourses. The increased price of bread is also one of the very surest of pointers that inflation is once more upon the march, and although at the time of writing it is only Mr Garfield Weston's Associated British Foods which has decided on the price increase this does account for about 20% of Britain's bread production and the other big baking groups are expected to follow, just as Gallaher of "Senior Service" fame followed Imperial Tobacco of "Players" and "Churchman" name with price increase on certain of their brands. If one cannot beat the inflationary spiral one does what millions of investors have already done—one joins it. One invests in equities.

Those, for example, who had invested in the 5s Ordinary shares of Elliott-Automation at the beginning of the year would be bound to agree. For, then, the shares stood at 25s 9d but are now around 34s 9d. Further ground, in fact, was gained last week when they rose from 33s 3d to 35s 1½d following the chairman's full report. This was a happy document. Mr Rudolph E. F. de Trafford disclosed that group sales last year spurted by £4 million to £20 million—a 25% increase, while the number of separate divisions had grown appreciably in the year and now exceeds 60. And despite the large growth in turnover, the group's order book has risen steadily since their last report so that the company can therefore look forward to further expansion in the volume of their business. During the current year—and five and a half months are already gone—both turnover and profits are continuing to show an encouraging upward trend so that in the absence of unforeseen circumstances Mr de Trafford can confidently look forward to a further improvement in 1961's results.

Better news, too, last week from Johnson and Phillips, the London electrical engineers and cable makers. In his full report which saw the shares up from 22s 3d to 24s 6d before they came back to 23s 9d, chairman Mr William Glass tells shareholders that the numerous period contracts for cables taken at the low prices prevailing at the end of 1959 have now been completed and since November last selling prices bear a more realistic relationship to costs.—*From our City Correspondent.*

Anglo-Portuguese Telephone

Net profit is up £63,661 at £613,591 and dividend is held at 9%. New applications for telephones are being received at the rate of 2,050 a month without any indications of slowing down, and both Lisbon and Oporto are growing rapidly, Mr A. F. Roger, chairman, states.

Automatic Telephone

A squeeze on margins of the parent company was responsible for the past year's surprise drop in profit, Sir Thomas Eades reveals. Sales were higher and the order book is now a record, but export competition is keen. In 1960 the company accounted for 40% of all UK exports of telephone switching apparatus.

Copeland and Jenkins (Holdings)

A final of 8% effectively raises the total distribution by 2% to 14% for the year. But group net profit, after smaller tax charge is down to £91,931 (*£105,349*).

Ever Ready (GB)

Turnover goes from strength to strength. The chairman reports that sales so far in the current year are higher than for the corresponding period last year. In the 12 months to 25 Feb., 1961, sales and profits were both records for the eighth successive year. As a measure of achievement, the company has not increased battery prices since 1951, and the industry has increased exports 4½ times in the decade to £7 million. But directors now feel that any further substantial increases in costs must have their effect on profits.

IST Insulations

Dividend is raised from 3d to 3¼d a 1s share for the year to 31 March and profit is up from £62,461 to £93,047 before £50,290 tax (*£29,500*).

Johnson and Phillips

Reserves are still strong at £4·9 million in relation to £2·9 million paid capital, the balance-sheet shows. So the transfer of £70,000 from dividend equalisation reserve, reducing it to nil, in order to pay a 5% dividend, which absorbs £51,058 with a further £34,453 required for Preference charges, is not of major significance. Current assets of £8·7 million are more than four times liabilities, and carry forward is almost steady at £142,528. Our table reflects only the doldrums, for in 1955 net profit was £281,087, a level which had been approximated for several years. The surprising thing about 1960 was that the record turnover of £10 million was fully £1 million higher than the previous year. The bulk of this increase was in cables, with the tonnage of copper processed up 60%, yet cables produced a loss. Although overtime was involved, Mr W. Glass, chairman, points to two advantages in handling this level of orders—future business and recouping overheads. The cable situation is still not satisfactory, Mr Glass says, but all expired contracts of substance have been renewed at higher prices, orders received in most departments have risen further, and overall results to the end of April exceed forecasts. "There are indications that we shall end the year with a level of profit more in accord with the high volume of sales," he adds cautiously.

Year to 31 Dec.	Trading Profit £	Net Profit £	% on Ord.		Ord. Price	
			Earned	Paid	High	Low
1956	350,469	33,310	0.1	10	46/6	26/3
1957	437,773	40,745	0.9	5	34/6	18/-
1958	375,751	21,155	—	5	28/-	15/-
1959	126,283*	144,084*	Loss	Nil†	30/6	16/9
1960	24,171	46,829*	Loss	5	24/3	16/6

* Loss. † A 3% capital distribution was made.

Relay Exchanges

The company's first wired television service in Kent is now well established and the new service in Swindon is expanding very rapidly, the chairman reports. Plans are in hand for similar developments in three other areas this year.

Solartron Electronic

Heavy investment for the future was the theme again last year, so that by the end of 1961 the company will be housed in two of the "most modern" manufacturing plants in the industry, with ample space for expansion. Some 25 new products were brought to the production stage in 1960, and plans to manufacture the Firth Cleveland tangential fan are well advanced. The chairman of the parent company, Firth Cleveland Ltd., also reports that Solartron-John Brown Automation are installing the first fully automated warehouse in Britain in a new building designed for storing frozen foods, and Firth Cleveland Instruments increased sales last year, though the benefit was offset by research expenses.

Telephone Rentals

Directors propose a one-for-five scrip issue and expect to maintain the 15% dividend on higher capital. Increased costs are unlikely to outweigh the expected rise in revenue for the current year.

Dividends Declared

Falk Stadelmann. Interim 5% (*same*).

Pye (Ireland). Final 13%, year 15% (steady).

Marco Refrigerators. Interim omitted. "Sales unsatisfactory," directors say.

a new pole top screwglass

An exciting new Pole Top Unit is now added to the extensive range of Simplex contemporary Screwglass fittings.

The Simplex Pole Top Screwglass is weatherproof and therefore suitable for all industrial and commercial applications.

It will take Tungsten or Mercury Fluorescent Lamps. The reflector is made from top quality anodised aluminium, stove enamelled red, yellow, turquoise, black or white as required. The moulded screwneck glass is internally etched to avoid glare and is protected by a strong galvanised wire guard.

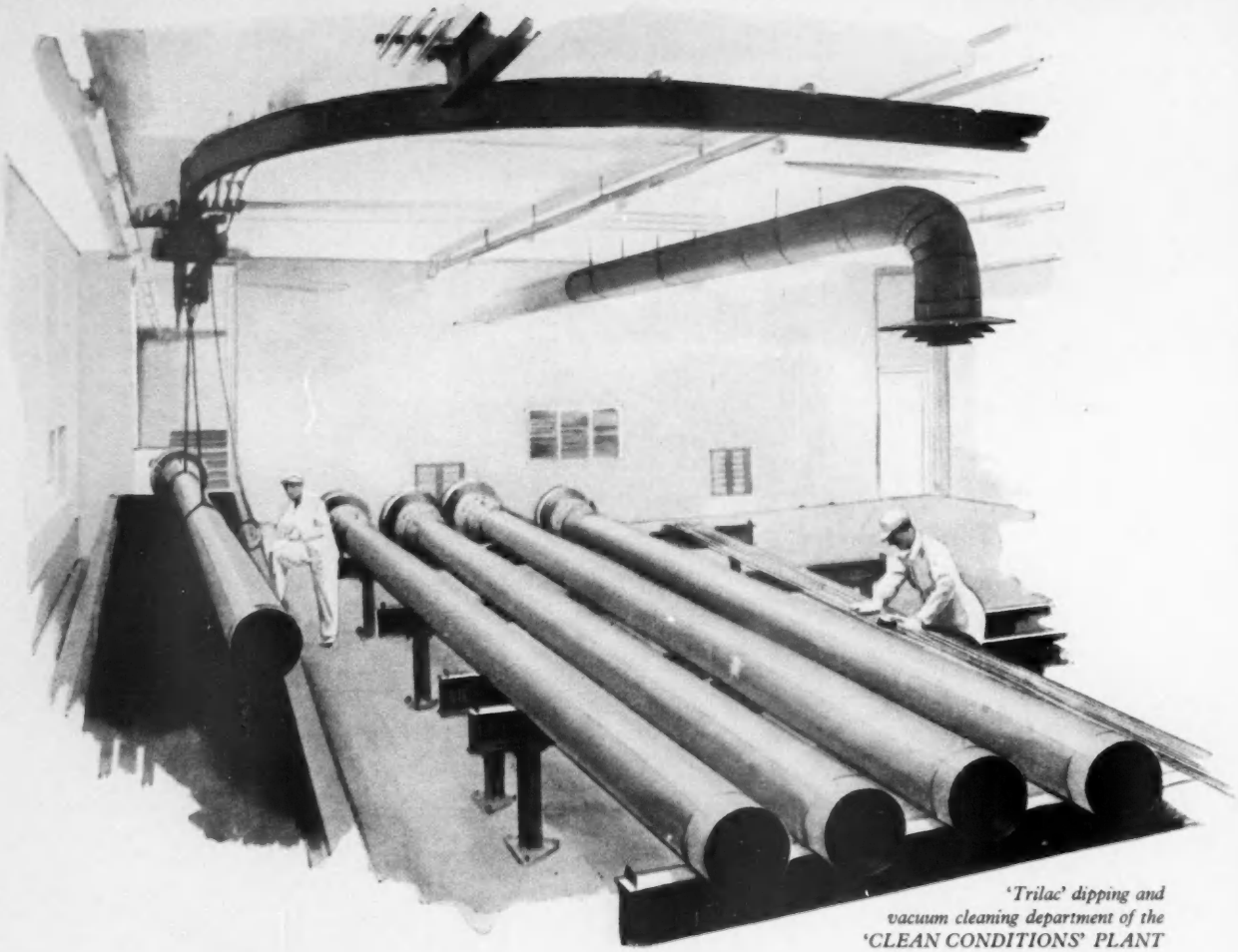
The comprehensive range of Screwglass Fittings allow easy installation in any situation, top or side entry, or wall mounting. Interchangeable Nylon reflectors in either red, yellow, turquoise, white or black can be added to enhance appearance.

Galvanised steel wire guard is also available for all sizes from 40 to 200W.

Simplex

ELECTRICAL DIVISION

For full details please write to :
SIMPLEX ELECTRIC CO. LTD., LIGHTING DEPT., CREDA WORKS, BLYTHE BRIDGE, STOKE-ON-TRENT, STAFFS.
Branches throughout Britain and agents throughout the world



'Trilac' dipping and vacuum cleaning department of the 'CLEAN CONDITIONS' PLANT

A COMPREHENSIVE PIPEWORK SERVICE

S & L, backed by a century of experience in the manipulation of pipework, has been associated for many years with power plant projects throughout the world.

In addition to manufacturing steel tubes the Company undertakes the design, supply and erection of complete pipework installations, including such ancillary equipment as supports, valves, pumps, tanks and lagging.

When required, an efficient site testing service can be provided in which examination of welds is carried out by radiographic or ultrasonic methods.

S & L have supplied steam installations for the highest pressures and temperatures appertaining to power stations as well as large quantities of low and medium pressure pipework for all kinds of industrial plant. The Company also supplies special tubes for control rod standpipes in nuclear power plants, as shown in the illustrations, and undertakes the clean conditioning of nuclear components.

PIPEWORK ENGINEERING DIVISION

STEWARTS AND LLOYDS LIMITED

Tubemakers for a Century

GLASGOW · BIRMINGHAM · LONDON

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a new pole top screwglass

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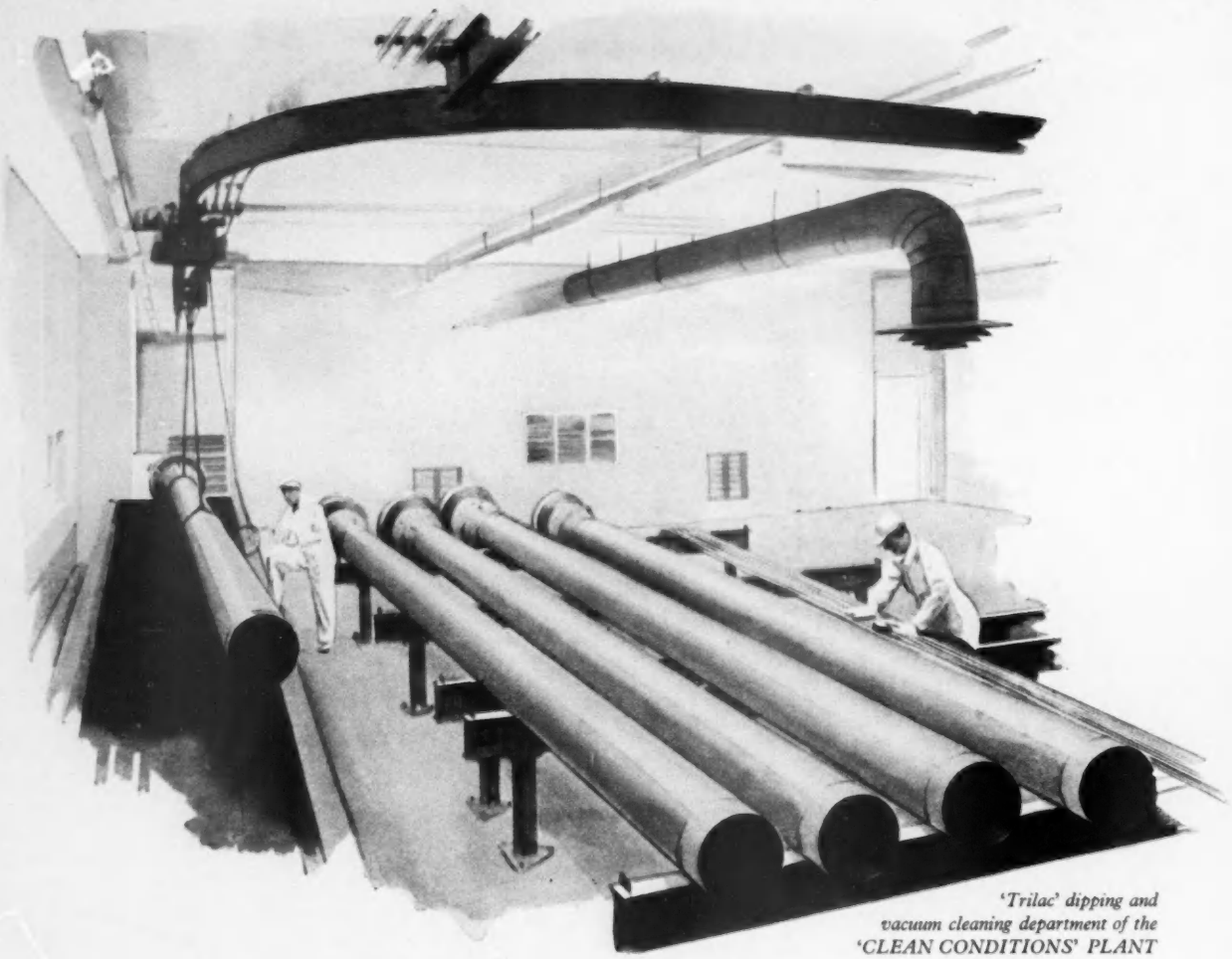

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COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders unless otherwise stated.

15 June—Bridge of Allan B.C. Electrical work in erection of 15 two-apartment and three three-apartment houses, Allandale Rd. —See 1 June issue.

15 June—Glasgow C.C. Separate trades tender No. 9. Electrical installation in proposed Fire Station at Easterhouse. Applications to City Architect and Director of Planning, 20 Trongate, by above date.

15 June—Manchester C.C. Supply of (a) 206 G.E.C. sodium lanterns/gear; (b) 203 "Byway" and "Midway" concrete columns; (c) 206 Sangamo timeswitches.—Advertised 1 June issue.

15 June—Workington B.C. Erection complete of 62 Class "A" concrete columns with sodium lighting.—See 8 June issue.

16 June—Lanark C.C. (1) 42 140 W sodium lanterns/gear for A8 Salsburgh scheme; (2) (a) 50 140 W sodium lanterns; (b) 50 transformers; (c) capacitors for A8 Harthill scheme.—Advertised 25 May issue.

16 June—Slough B.C. (7) Electrical installations in 238 houses, Parlaunt Pk, Langley. —See 8 June issue.

17 June—Whitchurch U.D.C. Dismantling of existing lighting and supply/erection/fitting of 70 30 ft steel columns and 200 W sodium lighting.—Advertised 25 May issue.

19 June—Brighton. Electrical installation, on fixed-price basis, in Brighton, Hove and Sussex Grammar School for Joint Education Committee.—See 8 June issue.

19 June—Dearne U.D.C. Rewiring of 64 houses, Carby Hall estate.—See 1 June issue.

19 June—Ennerdale R.D.C. Supply and erection of ten m.v. street lighting units at Parton.—See 8 June issue.

19 June—Manchester C.C. Contract 301. Electrical installations in 353 dwellings, Councillor La, Cheadle.—Advertised 8 June issue.

19 June—N.W. Metropolitan Hospital. Supply and installation of switchgear, distribution system, lighting, power and X-ray services; sound diffusion, clock, telephone, nurse call and staff location systems; standby diesel alternator and lighting protection system, at new Slough Hospital, Wexham Pk. Applications to Secretary, Regional Hospital Board, 40 Eastbourne Terr, W.2, by above date.

19 June—Scalby U.D.C. Supply and erection of 35 125 W and 5 ex-stock 80 W colour-corrected mercury vapour lamps for Hackness Rd, High St, North St, South St and Low St lighting improvement scheme. Supply of lanterns, time switches and ancillary materials for 125 W lamps. Supply of 18 ft steel columns/brackets. Erection and wiring of columns/painting. Surveyor, G. Horn, Council Offices. Deposit £2 2s.

19 June—Stocksbridge U.D.C. 255 60 W sodium lighting on 15 ft concrete columns. —See 25 May issue.

20 June—Bentley-with-Arksey U.D.C. Electrical installation in temporary office, Chapel St. Surveyor, Council Offices, Bentley. Deposit £1 1s. N.I.C. contractors only.

21 June—Durham C.C. Electrical installations in Peterlee Shotton Hall County Infant School and Peterlee Fire Station. Applications to County Architect. G. W. Gelson, South St, Durham, by above date.

21 June—Kingston upon Hull C.C. Electrical installations in (a) 62 dwellings, Hebden Ave and Molderness Rd; and (b) 113 dwellings, Boothferry estate, City Architect, D. C. H. Jenkin. Deposit £2, payable to City Treasurer for each scheme.

24 June—Belper U.D.C. Supply, erection and wiring of 14 Stanton columns with A.E.I. post-top fluorescent lanterns in King St.—See 8 June issue.

24 June—March U.D.C. Conversion, on fixed-price basis, of 324 tungsten lamps to mercury vapour colour-corrected. Engineer and Surveyor, W. S. Pickett, Town Hall. Deposit £2 2s.

26 June—Bury C.B.C. Electrical installation, alterations, etc., in abattoir extensions. —See 8 June issue.

26 June—Cannock U.D.C. Supply, erection and wiring of (a) 84 140 W sodium lamps/25 ft concrete columns along Pye Green Rd, Old Fallow Rd, Huntington Terr Rd and Belt Rd; and (b) 66 100 W tungsten lighting on new/existing columns along various roads. Engineer and Surveyor, E. Lomax, Council Hse, The Green.

26 June—Llanelly B.C. Connection of 166 street lights to mains supply.—See 8 June issue.

26 June—West Hartlepool B.C. Electrical installation renewal in Oxford St Infants' and Junior School. Borough Architect, A. G. Sinclair.

28 June—Cockermouth U.D.C. 16 street lighting units.—See 8 June issue.

28 June—G. Yarmouth C.B.C. (b) Electrical installation, on fixed-price basis, in H.Q., police station and area control premises at Howard St South.—See 8 June issue.

28 June—Middlesex C.C. Supply and erection of 14 steel columns, mercury lamps, lanterns, gear and wiring for lighting Wraysbury roundabout, Staines By-pass.—Advertised 8 June issue.

28 June—Port Talbot B.C. Street lighting scheme for Tir Morfa Rd, Scarlet Ave, Auburn Ave, Sandfields estate, comprising 23 15 ft concrete columns/arms, 23 chokes/condensers, lanterns and 80 W mercury lamps. Borough Engineer, G. V. Griffiths. Deposit £2 2s.

28 June—Trim U.D.C. Duplicate 125 g.p.m. pumps.—See 1 June issue.

29 June—Wortley R.D.C. Supply/installation of 32 cookers.—See 25 May issue.

29 June—Thornaby-on-Tees B.C. Tender: supply of Groups "A" and "B" lighting, consisting of 600 units, mercury vapour and sodium discharge lamps.—Advertised in this issue.

30 June—Belfast C.C. Supply and erection of air heater element cleaning equipment at Power Station West.—Advertised 1 June issue.

1 July—Bristol C.C. Operating gear for a centre bearing 900-ton swing bridge.—Advertised 8 June issue.

3 July—Clowne P.C. Provision and erection of 115 Group "A" concrete columns and sodium lighting along A616 and A618.—Advertised 8 June issue.

3 July—West Riding C.C. Rewiring, including emergency lighting system at Fairfield Hall, Addingham, Ilkley.—See 8 June issue.

14 July—Wortley R.D.C. Supply and installation of 40 "Highway" concrete columns with "Brampton" lanterns, lamps and control gear for Group "A" colour-corrected lighting scheme extension along Burncross and Hallwood roads, Chapeltown. Details from Mr. A. Wikeley, Council Offices, Grenoside, Sheffield.

No date stated—Somerset C.C. Supply: heavy duty cooking equipment, water heaters, potato peelers, mixing machines, etc.—See 25 May issue.

No date stated—West Lothian Water Board. Supply of electrically operated automatic control equipment for compensating water from impounding reservoirs. Applications to consulting engineers, R. H. Cuthbertson and Associates, 13 Eglinton Cres, Edinburgh 12.

. . . and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon Hse, Theobalds Rd, W.C.1, quoting reference.*

21 June—Formosa. Three single-phase a.c. testing sets for testing watt-hour meters. B.o.T. (ESB/18851/61/I.C.A.).*

22 June—India. Two indoor transformers, rated output 2,500 kVA 50 c/s. Commissioner, Coprn. of Madras. B.o.T. (ESB/18827/61).*

23 June—Germany (Federal Republic). Supply and installation 16,000 metres special 6 sq mm cable; 197 series 250 W transformers; 197 existing airfield lights. Bundesamt für Gewerbliche Wirtschaft, Frankfurt/Main.

24 June—India. 20 air circuit-breakers. National Coal Development Corpn, Chief Purchase Officer, Darbhanga Hse, Ranchi. B.o.T. (ESB/18457/61).*

26 June—Burma. 20,000 ft electrode No. 6 by 1 chromoid; 1,960 lb electrode M.S. Spec. BS 630:52 No. 14 s.w.g. Ferrospeed; 3,000 ft electrode Ferroloid C.I. No. 2, 10 s.w.g. Director-General, Union of Burma Purchase Board, Rangoon. B.o.T. (ESB/18838/61).*

27 June—Australia. 670 36 in. and 170 56 in. ceiling fans. Director of Wks, Dept of Wks. 225 Bouke St, Melbourne. B.o.T. (ESB/18555/61).*

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources, including an index of trade information with over 100,000 entries

A Selection from the 109 queries answered this week

"Duchess" potato peelers—address for? H.E.—Monsyd Kitchen Ware Ltd., 88 Hatton Gdn, E.C.1.

"Titan" stapling device for cables—suppliers of? L.S.—Industrial Stapling and Packaging Ltd., 7 Rathbone St, W.1.

"Demag" motors—agents for? P.B.—Arrow (Engrs.) Ltd., 7 South Wharf, W.2.

"Pertinax" bakelite laminated paper—agents for? S.G.—Engineering and Dielectric Products Ltd., 707 Victoria Hse, Southampton Row, W.C.1.

"Veltest" e.l.c.b. testers—makers of? J.B.—VSS Transformers Ltd., 4 Surrey La, Sheffield 1.

"Culinaire" domestic appliances—suppliers of? L.E.B.—Rogerson Page Ltd., Lower Guildford Rd, Knaphill, Woking, Surrey.

"Tawlite" lighting fittings—makers of? S.E.B.—The Taw Mfg. Co. Ltd., Campsbourne Wks, High St, N.8.

"Hopkinson" motors—address for? W.M.—Brush Electrical Engineering Co. Ltd., Loughborough, Leics.

"Combi" lighting fitting—agents for? R.P.—K. G. Roome and Co., 30 Meadvale Rd, W.5.

28 June—Burma. 400 coils t.r.s twin 3/·036, 250 V; 40 coils v.r.i. 7/·036, single 660 V; 20 coils weatherproof Mural 7/·036, single 250 V; and 30 coils weatherproof Mural 3/·036, single 250 V. Director-General, Union of Burma Purchase Board, Rangoon. B.o.T. (ESB/19142/61).*

28 June.—U.S.A. Six lightning arresters rated 97 kV, six insulating bases and discharge counters. B.o.T. (ESB/18847/61).*

29 June—Burma. 200 48 in. 230/240 V a.c. single-phase ceiling fans; 270 choke type regulators for 56 in. ceiling fans; 30 regulators, resistances type, for Revo ceiling fan, 56 in. Director-General, Union of Burma Purchase Board, Rangoon. B.o.T. (ESB/19143/61).*

29 June—U.S.A. Three indoor metal-clad generator voltage switchgear assemblies and bus structures for Flaming Gorge Power Plant. B.o.T. (ESB/18849/61).*

3 July—South Africa. 180 1,000 ohms relays fitted with heavy duty nickel-silver contacts, 5 A 250 V. Union Tender Board, Pretoria. B.o.T. (ESB/18869/61).*

3 July—Turkey. Supply and installation of diesel generators, a frequency converter, transformers, underground cables and erection of transformer and diesel generator stations. B.o.T. (GD/88/61/(32)).*

5 July—Argentina. Provision and initial operation of thermal power stations at Neuquen and Zapala. Ministry of Economy, Calle Presidente Roca 341, Neuquen. B.o.T. (ESB/18067/61).*

5 July—India. (a) Inquiry SE.378, 138 kV pedestal insulators; (b) Inquiry SE.379, coal wagon unloading plant; (c) Inquiry SE.381, 138 kV disconnecting switches; all for Chandrapura Power Station. Documents, fee £1 1s 6d per inquiry, from India Store Dept, Bromyard Ave, W.3.

5 July—New Zealand. 50 time delay recycling relays. Director-General (Stores Division), G.P.O. Wellington. B.o.T. (ESB/18586/61).*

5 July—Pakistan. Five complete 66 kV substations in W. Pakistan. West Pakistan Water and Power Development Authority, Lahore. B.o.T. (ESB/18868/61).*

5 July—South Vietnam. 150 condenser batteries 220 V 50 Hz1, with discharge resistance in 10 kVAr, 20 kVAr and 30 kVAr ratings. Central Purchasing Authority, Saigon. B.o.T. (ESB/19132/61).*

CONTRACTS PLACED

London C.C. Electrical installations in blocks 25 and 27, Brandon estate, Southwark, Holliday (Electrical) Ltd., £4,143 15s 7d. Lift installations block 3 Draper St site, £16,766 and Maida Vale site, blocks 4, 5 and 6, £40,758, Express Lift Co. Ltd.

Magor and St. Mellons R.D.C. Supply and erection of 179 200 W linear sodium lamps/gear/Amberline lanterns and 35 ft Stewarts and Lloyds steel columns along A48, A.E.I. Lamp and Lighting Co. Ltd., £12,000.

Oadby U.D.C. Supply and installation 35 Group "B" sodium lamps, and gear, plus erection and wiring 30 columns. A.E.I. Lamp and Lighting Co. Ltd., £984.

St. Marylebone B.C. Installation of Group "A" steel columns/fluorescent lanterns and Group "B" steel columns and post-top fluorescent lanterns. G.E.C. Ltd., £3,243 and £3,028, respectively. Recommended.

S.W. Metropolitan Hospitals. Electrical work: Operating theatre, etc., at Rowley Bristow Orthopaedic Hospital, Pyford, W.S. Patching and Son, £4,731; Operating theatre, Royal Hospital, Richmond, Wm. Steward and Co. Ltd., £3,651. Lift installation, Kingston Hospital, W. J. Furse and Co. (London) Ltd., £23,984. Recommended.

Wessex Hospital Board. Electrical work: Whitwell Ward, St. Mary's Hospital, Newport, I.o.W., H. Saunders Ltd., £750; Staff cottages, Park Prewett Hospital, Basingstoke, Homer-Gray Ltd., £3,257; St. James's Hospital, Portsmouth, G. E. Taylor and Co. (London) Ltd., £13,770. Recommended.

5 July—South Vietnam. 8,000 m, 1 kV cable; 5,000 m, 10 kV cable; and 23,000 m, 15 kV paper insulated, lead sheathed. Central Purchasing Authority, Saigon. B.o.T. (ESB/19131/61).*

6 July—America. 13·8 kV switchgear and bus structurers for Greers Ferry Dam and Reservoir, Little Red River U.S. Corps of Engineers, Little Rock District. B.o.T. (ESB/18590/61).*

6 July—India. 175-ton 0·0159, 0·020 and 0·335 diameter wire. Documents, fee 10s, from India Store Dept, Bromyard Ave, W.3, reference 2309/61/EM/ENG.1.

6 July—India. Two wave generating units fabricated with power drive. Indian Institute of Techonology, Bombay. B.o.T. (ESB/18810/61).*

10 July—Australia. 12 800 A 66 kV three-phase 50 cycle 2,500 MVA outdoor type circuit-breakers with nine current transformers; 12 1,600 A 66 kV three-phase 50 cycle, 2,500 MVA outdoor type circuit-breakers with nine current transformers. Secretary, State Electricity Commission of Victoria, Melbourne. B.o.T. (ESB/18834/61).

10 July—Pakistan. 670,000 yd house wiring cable. B.o.T. (ESB/19125/61).*

TRADE NOTES

Changes of address. This month, Mallory Batteries Ltd. are moving from their Dagenham works to a new factory at Gatwick Rd, Crawley, which is now nearing completion.

Davis Sheet Metal Engineering Co. Ltd. are moving to new premises at 27-37 Garman Rd, Tottenham, N.7 (telephone: Tottenham 3262), where they will be fully established by 1 Aug. In moving, the company have more than doubled factory and storage area. They also aim to increase their stocks of thousands of feet of trunking and accessories for early despatch to all parts of the country.

New showrooms. The Electrical Equipment Co. (N.I.) Ltd. have moved into new premises at Kelvin Hse, Adelaide St, Belfast, which includes a showroom. The company is setting up a subsidiary, Kelvin Manufacturing Co. to make industrial switchgear, initially on a small scale.

Absorbed. As from 1 July the Anglo Time Corporation will be absorbed into its parent company, B. H. Ries Ltd., of 19-21 Hatton Garden, E.C.1.

Gazette Announcements

COMPANIES ACTS

Brooks Ridley Ltd. Mr S. H. Reilly, 28 St. Mary's Pl, Newcastle upon Tyne 1, appointed liquidator at extraordinary general meeting on 16 May for the purpose of voluntarily winding-up.

Tipton Electrical Repairs Ltd. General meeting to be held at Tixall Hse, St. James's Rd, Dudley, on 10 July, at 12 noon, for the purpose of having an account of the winding-up laid before members.

R. and B. Marland Ltd. Mr J. A. Freeman, 8 Manchester Rd, Bury, appointed liquidator as from 21 April.

A. T. Barratt and Co. (Manchester) Ltd. Mr Smith Scoble, of 4 Rosewood Ave, Burnley, appointed liquidator at extraordinary general meeting on 1 June for the purpose of voluntarily winding-up.

W.E.A. Lectric Ltd. Mr G. A. Wale, Walter Hse, 418-422 Strand, W.C.2, appointed liquidator at extraordinary general meeting, on 24 May, for the purpose of voluntarily winding-up.

C. and W. Electrics Ltd. Mr G. C. Sagar, 31 Clarendon Rd, Leeds 2, appointed liquidator at extraordinary general meeting on 1 June for the purpose of voluntarily winding-up.

Viking Engineers Ltd. Mr G. Fraser, 42 Tottenham St, London W.1, appointed liquidator at extraordinary general meeting on 16 May for the purpose of voluntarily winding-up.

Regent Electrical Distributors (Middx) Ltd. Mr R. S. Towler, William Deacons Bank Chmbrs, Market St, Leigh, Lancs, appointed liquidator as from 31 May.

T.V.M. Electronics Ltd. Meeting of creditors will be held at offices of Latham and Co., Walter Hse, 418-422 Strand, W.C.2, at 12 noon, 19 June.

General Refrigeration Ltd. Meeting of creditors at Coventry Hse, South Pl, Moorgate, E.C.2, at 11.30 a.m., 3 July.

Regent Electrical Distributors (Middx) Ltd. Creditors to send names to liquidator: H. W. Pitt, 100 Park St, W.1, by 17 June. Creditors to be paid in full.

Norman Electrics Ltd. Meeting of creditors at offices of W. H. Cork, Gully and Co., 19 Eastcheap, E.C.3, at 11.30 a.m., 14 July.

BANKRUPTCY ACTS

Receiving Orders

Swindon. Electric Hse, electrical dealers, Market Cross, Malmesbury. Receiving order dated 31 May.

Wakefield. C. Arrand, agricultural and electrical engineer, carrying on business at 44 High St, Rawcliffe. Receiving order dated 29 May.

High Court of Justice. T. B. Jennings, electrical dealer, of 13 Albion Ave, London N.10. Order dated 2 June.

First Meetings and Public Examinations

High Court of Justice. R. S. Merryweather, electrical dealer, trading as Merryweathers, of 71 Cricklewood La, N.W.2, and lately carrying on business at 43 Mill La, N.W.6. First meeting: 11 a.m., 20 June and public examination: 11 a.m., 28 July, both at Bankruptcy Bldgs, Carey St, W.C.2.

High Court of Justice. D. J. Caradas and L. A. Richards, electrical dealers, carrying on business as J. and L. Television Maintenance, at 124 Lower Rd, Rotherhithe, London S.E.16. First meeting: 11 a.m., 23 June; and public examination: 11 a.m., 15 Aug., both at Bankruptcy Bldgs, Carey St, W.C.2.

Wakefield. C. Arrand, agricultural and electrical engineer, carrying on business at 44 High St, Rawcliffe. Public examination: 9.45 a.m., 26 July, at Court Hse, Wood St, Wakefield.

Coventry. R. J. Eales, electrical contractor and retailer, formerly carrying on business in partnership as B.T.E. Electrical Supplies, at Palmer La and 34 Primrose Hill St. Public examination: 11.15 a.m., 31 July, at County Hall, Coventry.

Manchester. G. E. Spence, formerly carrying on business as domestic appliance dealer under the name of S. and S. Appliances, at 79 Oldham Rd, Rochdale, and Rex Bldgs, Radcliffe. First meeting: Official Receiver's Office, 20 Byrom St, Manchester, 12 noon, 21 June; and public examination: 10.30 a.m., 18 Aug., at the Court Hse, Quay St.

St. Albans. F. W. Poole, formerly carrying on business as electrical appliance dealer at 393a High St, Watford. First meeting: 11.30 a.m., 16 June, 58-61 York Terr, London N.W.1; public examination: 11 a.m., 12 July, Town Hall, St. Albans.

Winding-up Orders

High Court of Justice. Cradley Electrical Maintenance Ltd. Regd. office: 117 Quarry Rd, Dudley Wood, Cradley Heath, Staffs. Order dated 5 June.

High Court of Justice. Lee Domestic Appliances Ltd. Regd. office: 47 Deptford Broadway, S.E.8. Order dated 5 June.

Intended Dividend

Harrogate. J. C. Bruce, electrical dealer and contractor, carrying on business at 3 Cunliffe Rd, Ilkley. Last day for receiving proofs for intended dividend: 20 June, by trustee: N. Tomblin, 16 Brook St, Ilkley.

BUSINESS PROSPECTS

Aldershot. A. J. Waite and Co. Ltd., Littlers Close, S.W.19, propose 105 houses, Deadbrook Farm estate.

Ash. H. T. Hill, Connaught Bldgs, Brookwood, propose 46 houses, South La.

Aylesbury. Drabble Construction Co. Ltd., Cannon St, Wellingborough, contractors for two factories, Gatehouse and Stocklake trading estates.

Ayr. Planned: 15 six-apartment houses, Kincaidston, Maybole Rd, costing £90,000, for Wm. McClure and Sons, Ayr Rd, Irvine. Mitchell Construction Co. Ltd., Peterborough, contractors for I.C.C. £½ million offices, Ardeer.

Barnet. McManus and Co. Ltd., 54 Station Rd, New Barnet, propose 83 dwellings, Bells Hill.

Barnstaple. Proposed: 45 dwellings, Sunset Heights estate, by G. Loosemore and Son, Summerland St. Covenant Securities Ltd., London, propose shop/office block, Queen St, costing £100,000; architect: R. H. Gallannaugh, 54 Queen St, W.1.

Barry B.C. Tender: 52 dwellings, Cornwall Rd. Engineer.

Basingstoke. Percy Bilton Ltd., 54 Uxbridge Rd, W.5, propose factory estate, Lister Rd.

Bathgate. Proposed: 60,000 sq ft extensions to Telegraph Condenser Co., Whiteside Wks. Contractors: Robert Paterson and Sons Ltd., Milton Rd, Airdrie, Lanark.

Battersea. B.C. propose 80 dwellings, Southlands. Engineer.

Beckenham. Halse and Sons Ltd., 80 High St, Woolwich, contractors for £101,000 old people's home.

Berks. Gerald Brown Foundation propose housing development, 6½ acres, Bouldish Farm estate, South Ascot.

Bexhill-on-Sea. Glanville Developments Ltd. propose six blocks of flats, Sunken Land.

Birmingham. Tender: housing development, Edgbaston. Artizan Group, 83 Hagley Rd, Birmingham 16. C.C. Tenders: Junior Training centres, Erdington, Stetchford and Harborne. Architect.

Bishop Auckland. Bishop Auckland Co-op Society Ltd., propose £30,000 supermarket.

Blaby. R.D.C. propose 200 houses, 1962 programme. Surveyor.

Blackpool. Manchester Regional Hospital Board, Cheetwood Rd, propose new ward block costing £158,000, Victoria Hospital.

Blaydon. Stephenson, Gillis and Ptnrs., Saville Chmbrs., Newcastle, architects for proposed residential hotel, Shibdon Rd, for Shield Bros.

Boldon. Gordon Durham and Co. Ltd., Moor La, contractors for 54 houses, Farm Hill estate.

Bolton. E. H. Evans Ltd., Bolton, propose housing development, 3½ acres, Mars Ave.

Bournemouth. Planned: two nine-storey blocks of flats, Poole Rd, for Gostelow Properties Ltd.

Bristol. J. A. Venn Ltd., 77 Ashgrove Rd, Bristol 7, propose 26 houses and two-storey flats, Hatcliffe estate.

Bullingdon. R.D.C. propose 500 traditional houses, Berinsfield estate.

Burnley. 80 dwellings, Deerpark Rd/Eastern Ave, proposed by Drury Estates Ltd., London Rd, Kettering.

Cambridge. East Anglian Regional Hospital Board, Cambridge, propose hospital for sub-normal, Fulbourn; architects: A. F. Scott and Sons, 23 Tombland, Norwich.

Carlisle. Littlewoods Mail Order Stores Ltd., Liverpool, propose redevelopment of property, English St.

Chatham B.C. Tender: 31 dwellings, Ordnance St, Perry St. Engineer.

Chelmsford. Proposed: 163 houses, Beechenlea estate, by Cooper Estates Ltd., Wilmington Hse, Wilmington.

Cheshire. Vauxhall Motors Ltd., Luton, propose new factory, Hooton Pk, near Ellesmere Port.

Chester C.C. Tender: 44 semi-detached houses, Highfield Rd, Blacon. City Engineer, 49 Northgate.

Chester-le-Street. Peter Clark Ltd., East Herrington, Sunderland, plan 88 houses, Birtley. Arndale Property Trust Ltd., Howard Hse, Bank St, Bradford, propose shops, Durham Rd, Birtley. Leslie and Co., 80 Woodside Rd, Darlington, contractors.

Chippenham. E. J. Pitt (Bldrs) Ltd., Criketts La, propose 37 houses, The Paddocks, Wood La.

Coventry. Corporation propose £123,000 hostel for mentally disordered, Torrington Ave.

Croydon C.B.C. Tender: 84 dwellings, two shops, Monks Hill housing estate. Engineer.

Culham. A.E.A., 11 Charles II St, S.W.1, propose laboratories, lecture theatre at new atomic establishment.

Didsbury. Cotton, Silk and Man-made Fibres Assoc., award £425,370 contract for chemical and mechanical finishing dept., to J. Gerrard and Sons Ltd., Swinton.

Disley. Albert Locke (1940) Ltd., 160 Higher Rd, Urmstown, Manchester, plan 120 dwellings, Dane Bank Farm.

Dublin C.C. Tender: fire station, Dolphin's Barn. City Architect.

Dudley C.B.C. Tender: redevelopment, Fisher St, Castle St. Architect.

Dundee. Morphy-Richards (Astral), St. Mary Cray, propose new factory.

Dungannon R.D.C. Tender: 158 houses, Plater's Hill, Coalisland. F. H. Wright and Ptnrs., 79 Botanic Ave, Belfast.

Durham. E. Pye and Sons, East Parade, Bishop Auckland, propose housing development, 26 acres, Brancepoth Castle area. N-E Housing Assen Ltd., Windsor Terr, Newcastle, propose 100 houses, Newton Hall estate. D. Glen Ltd., Jarrow, contractors for £146,938 West Pelton modern school at Stanley. R. Brown, 123 Victoria Rd, Darlington, architect for proposed Broom Cottages Modern School.

Easington. Proposed: supermarket, town centre, Peterlee, for L. and N. Stores; architects: Williamson and Ptnrs., St. Mary's Pl, Newcastle.

Eastleigh B.C. Tender: 50 dwellings, Velmore estate. Engineer.

Enfield. Knifton Contractors Ltd., Langhedge La, N.18, propose 58 dwellings, Ferns Nursery, Hertford Rd.

Exeter. Bell Properties (Construction) Ltd., London W.1, propose housing development, 42 acres, Windslade Park.

Falkirk. British Aluminium Co. Ltd., Bainsford, propose £10 million expansion scheme.

Fareham. Plessey Co. Ltd., Vicarage La, Ilford, propose new research centre.

Fleet. Campendium Properties Ltd. propose shops/flats, Odeon cinema site; architect: R. J. Husband, 126 Wigmore St, W.1.

Folkestone. Proposed: 52 flats, Beach Marine Hotel site, The Riviera, by V. V. Behar, Palm Beach, Sandgate.

Gateshead. N.-E. Housing Assoc. Ltd., award £362,240 contract for 212 dwellings, Leam La estate, to W. D. and R. Allison and Sons, Whitburn. T.C. propose 60 old people's flats, near Fountain View Home. Engineer.

Glasgow. Gula Investments Ltd., 25 Upper Brook St, W.1, propose £200,000 shops/offices, Sauchiehall St; contractors: Tersons Ltd., Dollis Pk, N.3. C.C. propose two extensive schemes at Ibroxholm and Mosspark, costing total of £2½ million. City Architect.

Glenrothes D.C. Weir Housing Corpn. Ltd., Coatbridge, propose 124 houses, South Parks.

Grangemouth. B.P. Refinery (Grangemouth) Ltd. propose £250,000 admin./catering/public relations block, Bo'ness Rd.

Hackney. B.C. propose 135 flats, Cazenove Rd, costing £511,000. Engineer.

Halifax. B.C. propose £400,000 swimming baths, Clare Hall site. Engineer.

Harlow. Proposed: by U.D.C. next stage of new town hall in form of tower block, costing £135,000. Frederick Gibberd, architect, 8 Percy St, W.1.

Hastings. Hallmark Group, 9 Wimpole St, W.1, propose 400 dwellings, 57 acres, Alexandra Park estate. N. Wyatt, 2 Castle Hill Rd, architect for proposed conversion to 84 flats of Eversfield Hotel, Eversfield Pl.

Hazel Grove. J. J. Oakes and Sons Ltd., 144 Dailstone La, Stepping Hill, proposes 60 houses, Bramhall Moor La.

Hexham. Morrison and Short, 11 Clayton Rd, Newcastle, architects for Perry and Ptnrs. proposed trading estate, Acomb.

Hoddesdon. £80,000 factory proposed by Morley's (Birmingham) Ltd. Architects: Cotton, Ballard and Blow, 5 Baker St, W.1.

Hook. Proposed: by E. J. Butler, housing development, 67 acres, Holt Farm, Holt La.

Hove B.C. Tender: 48 flats, Chichester Cl. Engineer.

Huddersfield. Lunn and Lunn, Market St, Milnsbridge, architects for £170,000 Y.M.C.A. hostel, Northumberland St.

Hull. Scruton and Co. (Bldrs) Ltd., West Carr La, Stoneferry, propose 602 dwellings, Beverley High Rd.

Ilford. B.C. propose £110,540 extensions to County High School for Boys.

Keynsham U.D.C. Tender: 24 dwellings, Broadlands estate. Architect.

Leamington Spa. Sunshine Houses, 18 Greenfield Cres, Edgbaston, propose 30 dwellings, Gunnery Farm, Cornwall Pl.

Leeds. George Wimpey Co. Ltd., awarded C.C. contract for £710,811 flats, Swinnow.

Leicester. S. Penn Smith, Waterloo Hse, Hastings St, architect for proposed £150,000 Gee Advertising H.Q., Regent Rd/West Wk.

Littlehampton. Planned: 31 dwellings, Lansdowne Gdn estate, by E. and L. Berg Ltd., Buckland Hse, Esher Park Ave, Esher.

London. R. S. Nickson, 6 Charterhouse Sq, W.1, architect for proposed 57 flats, Partinscale Rd, Wandsworth. Audley Properties Ltd. plan 15 flats costing £250,000, Hill St, Mayfair; contractors: Leslie and Co., Peel St, W.8. Minopirio and Spencely and P. W. McFarlane, 18 Seymour St, W.1, architects for proposed 793 dwellings, 24 shops, etc., Lonsdale Rd, on M.W.B. surplus land. Cost £1,913,000. Alex Wilson (London) Ltd., 3 Vine Ct, E.1, propose factory/warehouse, High St, E.13; architects: D. Stern and Ptnrs., 24 Gloucester Pl, W.1. B. Poulter, Stonebanks, Warlingham, architect for proposed Glass Developments Ltd., factory, Patmore, Battersea. X-ray department proposed for Hospital for Sick Children, Gt. Ormond St, W.C.1: architects: Easton and Robertson Cusdin, Preston and Smith, 53 Bedford Sq, W.C.1. Feast and Anderson, 52 Upper Berkeley St, W.1, architects for proposed MacFisheries Ltd., supermarket, High Rd, Wood Green. Capital and Counties Property Co. Ltd., 4 Lloyds Ave, E.C.3, propose £20 million development, Knightsbridge, Brompton Rd area: architects: Guy Morgan and Ptnrs., 12a Eaton Sq, S.W.1.

Maidenhead. Proposed: 106 dwellings, Cookham Rd, by McManus and Co., Potters Bar, Middx. 55 dwellings, Clader Lodge, proposed by G. and M. Construction Ltd., 426 Harrow Rd, Paddington, W.9. Wm. Heath Ltd., Gerrards Cross, Bucks, propose 70 houses, Belmont Farm.

Maidstone. Sterling Homes Ltd., 26 Manchester Sq, W.1, propose 162 dwellings, Queens Rd/Palace Farm estate.

Manchester. New factory, Nash Rd Wks, Trafford Park, proposed by Victor Blagden (Manchester) Ltd. Contractors: Lowton Construction Co. Ltd., Lowton, Lancs.

March. S. W. Shelton Ltd., South St, Stanground, Peterborough, proposes 39 bungalows/chalets, Westwood Hse site, Norwood Rd.

Market Harborough. Tender: Slaughterhouse, Springfield St. Engineer.

Middlesbrough. Kitching and Co., 21

Business Prospects—continued

Albert Rd, architects for proposed residential hotel, Roman Rd, for Masonic Hall (Middlesbrough) Ltd.

Musselburgh. Crudens Ltd., Musselburgh, propose £65,000 flats/houses, Newhailes.

Newbury. 27 bungalows, Cromwell Rd, proposed by Tile Barn Estate Ltd. Gregory Housing Ltd., Worthing, contractors for 131 dwellings, Chapel St, Thatcham, costing £256,393.

Newcastle. C.C. propose £250,000 scheme for shops/stores/library/flats, Fawdon; City Architect. C. A. Parsons and Co. Ltd., Shields Rd, propose bay for transformer production and testing. D. Brown, 10 Lambton Rd, Jesmond, architect for proposed St. Augustine's R.C. Secondary School.

New Milton. H. G. Stevenson, Milton Nurseries, Ashley Rd, proposes 276 dwellings on nurseries site. H. H. Drew and Son Ltd., Station Rd, proposes 195 flats, five shops, on 11 acres, Fernhill Manor estate.

Norman Cross. R.D.C. propose pumping station, sewage disposal wks, Elton, Holme and Sibson-cum-Stibbington, cost £190,000.

Northampton. H. C. Janes Ltd., High Town Rd, Luton, propose 306 dwellings, Harborough and Broughton Rds.

Northern Ireland. Housing Trust, 12 Hope St, Belfast 12, propose housing development, 360 acres, Dundonald.

Northwood. £111,000 contract for 12 shops, 24 flats, Green La, for Copse Wood (Northwood) Investments Ltd., awarded to A. E. A. Prowting Ltd., Bury St, Ruislip.

Norwich. East Anglian Regional Hospital Board, Cambridge, propose three villas costing £156,665, Little Plumstead Hospital.

Oakengates. Shipway and Ptnrs. Ltd., 1294 Bristol Rd South, Birmingham, propose 300 houses, Eaton Manor estates, and 300 houses, St. Georges.

Ormskirk. Jas. Grundy and Co. Ltd., Brownlow St, St. Helens, propose 4½-acre engineering factory, Mill La, Rainford.

Oxford. B.M.C. propose factory on industrial site, nr. Cowley Station.

Paulton. £300,000 printing works proposed by Purnell and Sons, Paulton, Midsomer Norton. Engineer: E. N. Underwood, 18 Regent St, Bristol 8.

Perth C.C. Tender: 114 dwellings, Letham housing development. Surveyor.

Portsmouth. Percy Bilton Ltd., 54 Uxbridge Rd, W.5, propose development of industrial estate, Western Rd, Paulsgrove.

Reading. J. West (Bldrs) Ltd., Bath Rd, propose 31 houses, Little Johns La/Gordon Pl.

Redditch. 71 houses, Lodge Park estate, proposed by Lodge Farm Developments Ltd., Redditch.

Romford. Geo. Wimpey and Co. Ltd., Hammersmith Grove, W.6, propose 45 dwellings, Chigwell Row.

Rotherham R.D.C. Proposed: £21,000 pumping station, Ulley. Engineer.

Salford. Sutton Dwellings Trust, Victoria Hse, Southampton Row, W.C.1, propose 112 flats in 17-storey block, three shops, four-storey block of maisonnettes, old people's club, Seedley Rd.

St. Albans. Proposed: 80 dwellings, London Rd, by T. and B. (St. Albans) Ltd., 69 Victoria Rd.

Seascale. John Twiname Ltd., Allerdale Hse, Brigham, Cockermouth, propose 80 houses, Wasdale Park.

Send. B. F. Tuckley, High St, Ganningham, and A. W. Hasledine, 56 Reigate Hill, Reigate, propose 136 houses, Send Nursery site.

Sheffield. B.I.S.R.A., Hoyle St, propose laboratory extensions, Hoyle St. Offices/showrooms/warehouse proposed at St. Mary's Gate by Kerry's (G.B.) Ltd., Furnival St. Proposed: hotel/shops/indoor car park, site of Hippodrome, adjoining Cambridge St, to cost £1 million; architects: Shepherd, Fowler and Marshall, 15 St. James Row.

Southport. Proposed: flats/restaurant, junction of Leicester St and Albert Rd for Town and Commercial Properties Ltd., 25 Grosvenor St, W.1.

South Shields C.B.C. Tender: 107 houses, Reading Rd, Brinkburn estate. Engineer. Ceres Investments Ltd., propose shops on site of Palace Cinema, Frederick St; architects: S. J. Hill and Ptnrs., 2 Whitfield St, Gloucester.

Staines. Tersons Ltd., 4 Dollis Park, N.3, contractors for eight blocks of flats, Laleham Rd. for E. Alex Coleman Group. Cost: £180,000.

Watford. Planned: 62 dwellings, High Rd/Shepcot La, for A. Pitkin Ltd., 63 High St, Rickmansworth. Fassnidge, Son and Norris, Uxbridge, contractors for Y.M.C.A. hostel, costing £137,000, Clarendon Rd.

Wilmslow. Wilmslow Hotel Development Co. Ltd., propose 11-storey luxury hotel, four-storey B.E.A. Silver Wings Club, six shops, etc., costing £800,000.

Wokingham. 127 houses, Coppice estate, planned by Jas. Miller and Ptnrs., Woodley, Berks. 70 flats, "The Elms," proposed by Widmore Finance Co.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons Ltd., 116 Chancery La, W.C.2.

Auto Marine Supplies (Wallasey) Ltd. To take over the business of manufacturers of and dealers in fibre glass products and electrical and electronic equipment carried on at 118 King St, Wallasey, and elsewhere, by Auto Marine Supplies, etc. Nom. cap.: £1,000. Dirs.: to be appointed by subs. Subs.: Stanley C. Davis and Mrs M. Davis, 12 Pickering Rd, New Brighton.

Danavox (Gt. Britain) Ltd., 9 Philpot La, Eastcheap, E.C.3. Manufacturers of and dealers in electronic devices of all kinds, etc. Nom. cap.: £3,000. Dirs.: Kenneth R. Knell and Pieter Greervliet.

Dane Electrical Controls Ltd. Nom. cap.: £45,000. Dirs.: Harold E. Bailey, Chas. H. Buckley and Edwd. Dickinson. Subs.: Leonard K. Taylor, 81 Fountain St, Manchester 2; and Ian B. Stewart, 53 Spring Gdns, Manchester.

Electronic Measuring and Test Instruments Ltd., 79 Silverdale Gdns, Hayes, Middx. Nom. cap.: £3,000. Dir.: W. A. Dunn.

Hivolt (Manufacturing) Ltd. Electrical engineers, high voltage generator manufacturers and dealers, etc. Nom. cap.: £1,000. Dirs.: not named. Subs.: Michael J. Warburton and Timothy C. Constable, 5 New Court, W.C.2.

Longton and Wilkinson Ltd., 137 Park Rd, Preston. Electrical engineers and general electrical installation contractors, etc. Nom. cap.: £500. Dirs.: Lawrence S. Longton and Ernest L. Wilkinson.

Modern Appliances (Castleford) Ltd., 42 Beaucroft Rd, Castleford. Manufacturers of and dealers in electrical appliances, etc. Nom. cap.: £1,000. Dirs.: Ernest Riley, Mrs O. Riley and Mrs Rose Waite.

Neville's Electrical Installations Ltd., 8 George Rd, Edgbaston, Birmingham 15. Nom. cap.: £500. Dirs.: Philip Neville, Gordon P. Neville and Mrs Ethel Neville.

Pye Switches Ltd. To make, manufacture and deal in precision and other switches, etc. Nom. cap.: £100. Dirs.: not named. Subs.: James A. Cowell, 11 Lichfield Rd, Cambridge; and Raymond Halksworth, 60 Hartington Grove, Cambridge.

Ryness Electrical Supplies Ltd., 37 Goodge St, W.1. Nom. cap.: £1,000. Dirs.: Joseph W. Ryness and Gladys Ryness.

Sentinel Alarm (Manufacturing) Co. Ltd., 329-33 High St, E.15. Nom. cap.: £100. Dirs.: David J. McSorley and John T. Robins.

R. and B. Star (Electrical Wholesalers) Ltd., 1-3 Erith Rd, Bexleyheath, Kent. Nom. cap.: £100. Dirs.: Wm. H. Robertson and Raymond G. Trull.

Staveley Electrical Ltd., Gatefoot Mill, Staveley, Kendal. Nom. cap.: £1,000. Dirs.: Edward Bate and Mrs I. Bate.

Technical Tape Ltd., 22 Great Smith St, S.W.1. Manufacturers of and dealers in adhesive, electronic and industrial tapes of all kinds, etc. Nom. cap.: £1,000. Dirs.: Desmond H. R. Burgess and Justus G. Jones.

Trilectric Ltd., 83 Burnham Way, W.5. Electricians, etc. Nom. cap.: £1,000. Dirs.: Brian E. Foster, Mrs Jean E. Wise and Mrs Betty R. Paine.

Washing Machines (Card'ff) Ltd., 59 Paget St, Grangetown, Cardiff. Nom. cap.: £1,000. Dirs.: Richard J. Nicholas and Mrs S. D. Nicholas.

John White (Electrical) Ltd., 106 High St, Southend-on-Sea. Manufacturers of and dealers in general electrical equipment, etc. Nom. cap.: £1,000. Dirs.: John A. White and Dorothy White.

T. and C. Williams (Electrical Contractors) Ltd., 308 Handsworth Rd, Sheffield. Nom. cap.: £100. Dirs. Thomas Williams and Colin Williams.

MEETINGS TO NOTE

TUESDAY, 20 JUNE

I.E.E. S. Midlands Centre. Centre diamond jubilee celebration visit until 22 June.

WEDNESDAY, 21 JUNE

INTERNATIONAL PLASTICS EXHIBITION AND CONVENTION at Olympia until 25 June.

THURSDAY, 22 JUNE

A.S.E.E. (S. London). "Public Supply Distribution." Greyhound Hotel, High St, Croydon. 8 p.m.

MONDAY, 26 JUNE

BRITISH LIGHTING COUNCIL. Conference "Lighting for the Small Home." Lighting Demonstration Centre, B.L.C., 16-18 Lancaster Pl, W.C.2. 2.30 p.m.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Axiatherm. 815,460. Class 11. Heating apparatus. Sterling Eng. Co. Ltd., Sterling Wks, Dagenham, Essex.

Brensonic. 808,136. Class 9. Apparatus, etc. Brenray Industries Ltd., 50 High St, Brentford.

Burgot Direct Link. 810,235. Class 9. Burglar and fire alarms, etc. Burgot Alarms Ltd., 26 Westbourne Grove, W.2.

Ceraflux. 817,836. Class 7. Magnetic work holders, drivers, positioning devices, etc. F. Pratt and Co. Ltd., Park Wks, Lister La, Halifax.

Chemodan. 807,602. Class 7. Pumps, agitators, mixers, pulverising machines, grinding mills, for use in the chemical industry. Edwin Danks and Co. (Oldbury) Ltd., Oldbury Boiler Wks, Oldbury, Birmingham.

Datacom. 817,052. Class 9. Telephonic, telegraphic and radio instruments and apparatus. Associated Electrical Industries Ltd., 33 Grosvenor Pl, S.W.1.

Diner-cold. B812,025. Class 11. Refrigerators, etc. Tricity Cookers Ltd., Thorn Hse, Upper St. Martin's La, W.C.2.

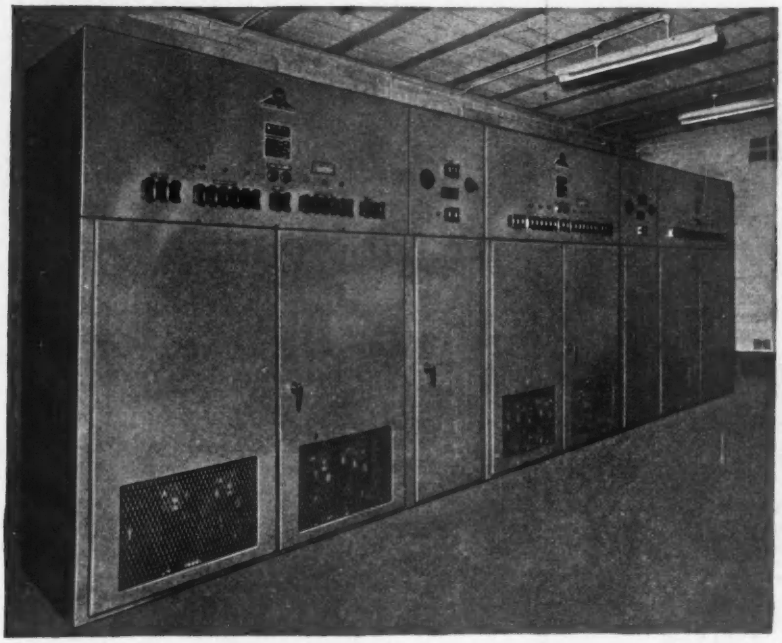
Fleetway. 797,798. Class 7. Washing machines, etc. Fleetway Manfg Co. Ltd., Winton Hse, St. Andrew St, E.C.4.

Jaycell in design. 811,604. Class 7. Sewing machines. Jaycell Ltd., 19 Whitechurch La, E.1.

Kemwell. 801,199. Class 9. Welding apparatus, etc. Kemwell (Chur) Ltd., Alexanderstrasse 8, Chur, Graubunden, Switzerland.

Orpheus Silex. 816,643. Class 9. Record players, etc. Orpheus Sound Reproduction Equipment Pty Ltd., 3 Ballater St. Essendon, near Melbourne, Victoria, Australia.

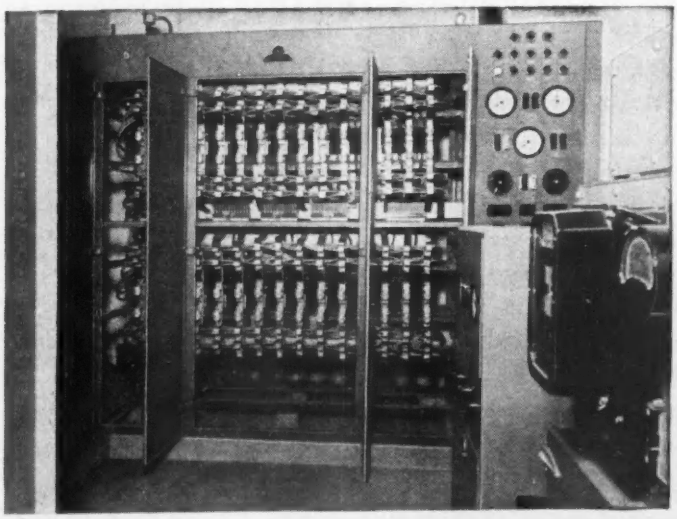
Pakamatic Pel'can. 811,164. Class 11. Installations for domestic lighting, heating, drying, refrigerating, etc. Servitor Textiles Ltd., Moorside Mill, Moorside, Oldham.



A 1300 kW bank of Hewittic Germanium Rectifiers installed in the Shipyard of Messrs. Cammell Laird & Co. (S & E) Ltd., Birkenhead, for providing D.C. for shore to ship supply.

Germanium

rectifiers

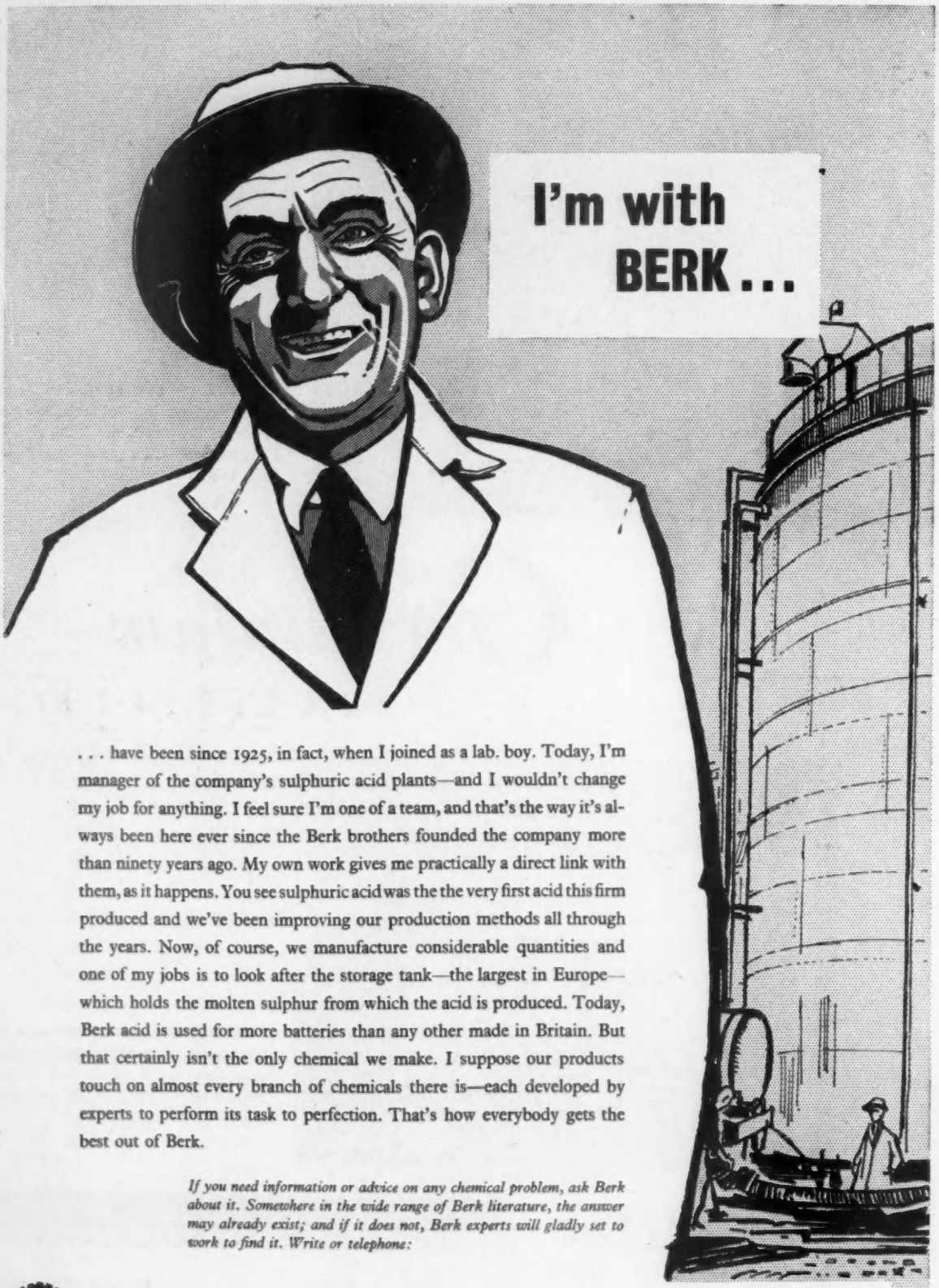


A 6000 amp Hewittic Water-cooled Germanium rectifier providing a continuous output at 100 volts D.C. for an electrochemical process at the Luton works of Laporte Industries Ltd.

by Hewittic

HACKBRIDGE AND HEWITTIC ELECTRIC COMPANY LIMITED

HERSHAM · WALTON-ON-THAMES · SURREY Telephone: Walton-on-Thames 28833 (8 lines) Telegrams & Cables: Electric Walton-on-Thames



I'm with BERK...

. . . have been since 1925, in fact, when I joined as a lab. boy. Today, I'm manager of the company's sulphuric acid plants—and I wouldn't change my job for anything. I feel sure I'm one of a team, and that's the way it's always been here ever since the Berk brothers founded the company more than ninety years ago. My own work gives me practically a direct link with them, as it happens. You see sulphuric acid was the the very first acid this firm produced and we've been improving our production methods all through the years. Now, of course, we manufacture considerable quantities and one of my jobs is to look after the storage tank—the largest in Europe—which holds the molten sulphur from which the acid is produced. Today, Berk acid is used for more batteries than any other made in Britain. But that certainly isn't the only chemical we make. I suppose our products touch on almost every branch of chemicals there is—each developed by experts to perform its task to perfection. That's how everybody gets the best out of Berk.

If you need information or advice on any chemical problem, ask Berk about it. Somewhere in the wide range of Berk literature, the answer may already exist; and if it does not, Berk experts will gladly set to work to find it. Write or telephone:

F. W. BERK & CO. LTD. BERK HOUSE, 8 BAKER STREET, LONDON, W.1 *Telephone:* HUNter 6688

CLASSIFIED ADVERTISEMENTS

TENDERS INVITED

BOROUGH OF THORNABY-ON-TEES
Street Lighting Equipment

TENDERS are invited for the supply of equipment for Group "A" and Group "B" lighting. Approximately 600 units are involved, including Mercury Vapour and Sodium Discharge lamps. Tender documents which include specifications for columns, lanterns, transformers and capacitators may be obtained from the Borough Engineer, Town Hall, Thornaby-on-Tees. Tenders are returnable to me in a plain sealed envelope endorsed "Street Lighting" not later than 10 a.m. on 29 June, 1961.

A. STOCKWELL,
Town Clerk.
(B 184)

TRINIDAD AND TOBAGO ELECTRICITY COMMISSION
Port-of-Spain "B" Power Station
CONTRACT No. 216.
P.C.R. REF. No. 1054/1011.

TENDERS are invited for the supply and erection of Two 50,000 kW Turbo-alternators and ancillary plant for the Port-of-Spain "B" Power Station.

Tenders are invited only from firms who are prepared to submit complete tenders for each contract.

A short précis of the extent of the works for which complete and comprehensive offers are invited may be had on application to Messrs Preece, Cardew and Rider, 8, 10 and 12 Queen Anne's Gate, London S.W.1.

Tender documents, which will be available from 19 June, 1961, and returnable by mid-day on 11 Sept., 1961, may be obtained from the same address on receipt of a payment by cheque for £15 in favour of Preece, Cardew and Rider. This payment will not be refunded.

At a later date offers will be invited for Auxiliary Switchgear and Cabling. Persons interested in such should NOT now apply, but await further advertisements.

The Trinidad and Tobago Electricity Commission do not bind themselves to accept the lowest of any Tender, nor will they be responsible for any costs incurred by Tenderers on making their Tender.

(B 156)

APPOINTMENTS VACANT

CENTRAL ELECTRICITY GENERATING BOARD
North Eastern and Yorkshire Region
REGIONAL ELECTRICAL DEPARTMENT

APPLICATIONS are invited for the following appointments in the Transmission Project Branch of the Regional Electrical Department based on Leeds.

1. THIRD ASSISTANT ENGINEER
(SUBSTATIONS)
GRADE 8, CLASS BX (£1,145/£1,410)

The successful applicant will be expected to supervise the work of Contractors engaged on the installation of substation plant and equipment including cables.

He should have a sound technical and practical training. Experience of both the

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maintenance and construction of substation plant and equipment is desirable, but applicants with experience of either will be considered. It is desirable that candidates should have qualifications leading to Corporate Membership of the I.E.E.

2. FOURTH ASSISTANT ENGINEERS
(SUBSTATIONS)
GRADE 11, CLASS BX (£900/£1,165)

The successful applicants will be required to supervise the work of Contractors engaged on the installation of transformers, switchgear cables and associated equipment at transmission substations. Previous experience of this work is desirable but not essential.

Preference will be given to candidates who possess or are completing technical qualifications leading to Corporate Membership of the I.E.E.

3. THIRD ASSISTANT ENGINEERS
(OVERHEAD LINES)
GRADE 8, CLASS BX (£1,145/£1,410)

The successful applicants will be required to supervise the work of Contractors engaged on the erection of main Transmission Overhead Lines. Previous experience in all aspects of the setting out and erection of lattice steel tower lines is essential.

Preference will be given to candidates who possess, or are completing technical qualifications leading to Corporate Membership of an appropriate professional engineering institution.

4. THIRD ASSISTANT ENGINEER
(SPECIFICATIONS AND CONTRACTS)
GRADE 7, CLASS BX (£1,235/£1,500)

To assist with the preparation of Specifications for all items of plant and equipment at main transmission substations. Ability to direct the preparation of all necessary drawings is required and the applicant will be required to engineer all aspects of the work up to the stage of commencement on site including all contract correspondence.

Candidates should possess technical qualifications leading to Corporate Membership of the I.E.E.

5. FOURTH ASSISTANT ENGINEER
(SPECIFICATION AND CONTRACTS)
GRADE 10, CLASS BX (£980/£1,245)

To assist the Third Assistant Engineers with the preparation of Specifications for all items of plant and equipment at main transmission substations in duties as defined above.

Preference will be given to candidates who possess or are completing technical qualifications leading to Corporate Membership of the I.E.E.

6. FOURTH ASSISTANT ENGINEER
(PROGRAMMES AND PROGRESS)
GRADE 9, CLASS BX (£1,050/£1,325)

To assist in the programming and progress of all Transmission Contracts within the Region, including the preparation of bar charts, etc.

It is desirable that candidates should have qualifications leading to Corporate Membership of the I.E.E.

Forms of application may be obtained from the Assistant Regional Secretary (Personnel), Central Electricity Generating Board, North Eastern and Yorkshire Region, 1 Whitehall Rd, Leeds 1, to whom they should be returned stating the appointment applied for to arrive not later than 30 June, 1961. (B 165)

THE SOUTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the following positions:—

SWANSEA AND WEST CENTRAL AREA
LLANELLY DISTRICT

(a) ASSISTANT ENGINEER
(reference 74a/61/ET)

(b) ASSISTANT COMMERCIAL ENGINEER
(reference 74b/61/ET)

Preference will be given to Engineers possessing the Higher National Certificate in Electrical Engineering.

Salary for both positions: N.J.B. Class G, Grade 9, Scale 7, £965/£1,090 per annum.

Applications stating age, present position, present salary, qualifications, experience and endorsing envelope with the appropriate reference should be addressed to G.R.T. Edwards, B.SC., M.I.E.E., M.AM.I.E.E., Manager, Swansea and West Central Area, 29 Ystrad Rd, Swansea Industrial Estate, Swansea, to reach him not later than 30 June, 1961

R. G. WILLIAMS,
Secretary.
(B 162)

SURREY EDUCATION COMMITTEE
Kingston Technical College
Fassett Road, Kingston upon Thames

REQUIRED 1 Sept., 1961:
LECTURER IN
ELECTRICAL ENGINEERING

Should possess degree in Electrical Engineering and/or appropriate professional qualifications, preferably with teaching and industrial or research experience and be prepared to teach to final year Higher National Diploma level in a wide range of Electrical Engineering subjects, with preference for heavy current engineering. Salary: Burnham Technical Scale (now under review), £1,370 x £35(4)/£40—£1,550, plus London Allowance.

Application form and further particulars from Principal, to be returned as soon as possible. (B 155)

CENTRAL ELECTRICITY GENERATING BOARD
South Wales Division

APPLICATIONS are invited for the following superannuable N.J.B. Schedule A appointments in the South Wales Division.

ASSISTANT MAINTENANCE ENGINEER
(MECHANICAL)
UPPER BOAT POWER STATION
NR. PONTYPRIDD, GLAM
Vacancy No. 203/ET/61.

Salary: Class H, Grade 9, Scale 8, £1,040/£1,165 per annum.

Applicants should possess appropriate engineering qualifications. Experience in power station mechanical maintenance and maintenance planning desirable.

ASSISTANT SHIFT CHARGE ENGINEER
UPPER BOAT POWER STATION
NR. PONTYPRIDD, GLAM.
Vacancy No. 205/ET/61.

Salary: Class H, Grade 9, Scale 8, £1,040/£1,165 per annum, plus 10% shift enhancement.

Applicants should possess H.N.C. or equivalent qualifications and have had operating experience in a power station.

PLANT CONTROL ENGINEER
ROGERSTONE POWER STATION
NR. NEWPORT, MON.
Vacancy No. 206/ET/61.

Salary: Class G, Grade 10, Scale 6, £890/£1,015 per annum plus 10% shift enhancement.

Applicants should possess H.N.C. or equivalent qualifications. Experience of operation on modern high pressure and temperature unit plant desirable.

Special application forms obtainable from Divisional Secretary, Central Electricity Generating Board, South Wales Division, Twyn-y-fedwen Rd, Gabalfa, Cardiff, to be returned by 1 July, 1961. (B 171)

Advertisements should be sent to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia Street, London, W.C.2, before 10 a.m. on TUESDAY of the week of issue. Official Displayed Advertisements are charged at 46s. per inch, and all other classified advertisements at 3s. 6d. per line. Situations Wanted four insertions at twice the single insertion rate. Fee for Box Number and postage on replies 2s.

CENTRAL ELECTRICITY GENERATING BOARD

South Eastern Region

REGIONAL RESEARCH AND DEVELOPMENT DEPARTMENT

ELECTRICAL BRANCH

APPLICATIONS are invited for the following positions in the above Department, located at West Farm Pl, Chalk La, Cockfosters, Herts, unless otherwise indicated. Salaries, inclusive of London allowance, will be within the ranges described, dependent on experience in accordance with Schedule B, Class CX, of the N.J.B. Agreement.

TRANSMISSION SECTION HEAD
Vac. No. S.E.21/61.

Grade 3/4/5, £1,435/£2,145 per annum.

The successful candidate will be required to lead a team on research and development work entailing a reasonable amount of field work on overhead lines, underground cables, switching and transforming stations and associated equipment. In addition, he will be responsible for a specialist engineer engaged on cathodic protection and buried corrosion.

Applicants should have a sound technical training with experience in electrical power system work. A recognised electrical engineering qualification leading to Corporate Membership of the Institution of Electrical Engineers is essential and a University Degree would be an advantage.

ASSISTANT ENGINEER
ELECTRICAL BRANCH
Vac. No. S.E.22/61.

Grade 6/7/8, £1,155/£1,780 per annum.

The successful candidate will be responsible to the Transmission Section Head to assist in the electrical laboratory and with field work on technical problems concerning electrical transmission plant. Similar, though not such wide, experience as that required for the Transmission Section Head would be desirable.

ASSISTANT ENGINEER
ELECTRICAL BRANCH
Vac. No. S.E.23/61.

Grade 6/7/8, £1,155/£1,780 per annum.

The successful candidate will be responsible to the Generation Section Head and will assist in the electrical laboratory and with field work on technical problems and special investigations concerning generating plant performance. A knowledge of the operation and design of electrical plant in generating stations is needed.

ASSISTANT ENGINEER
ELECTRICAL BRANCH
Vac. No. S.E.24/61.

Grade 6/7/8, £1,155/£1,780 per annum.

The successful candidate will be responsible to the Measurements and Instrumentation Section Head to assist in the electrical laboratory and with field work on technical problems arising from the application of known and new methods of instrumentation to plant in generating stations and transmission substations. He will be associated with instrumentation and measurement techniques developed for automatic control research and computer engineering knowledge will be an asset.

ASSISTANT ENGINEER
ELECTRICAL BRANCH
Vac. No. S.E.25/61.

Grade 6/7/8, £1,155/£1,780 per annum.

The successful candidate will be responsible to the Measurements and Instrumentation Section Head and will carry out special field work, developing his own techniques in radio and television interference measurements with noise level measurement and noise suppression, harmonic and vibration analysis, mechanical stress and strain analysis and allied work. This post requires experience in electronics and measurement techniques.

ASSISTANT ENGINEER
ELECTRICAL BRANCH
Vac. No. S.E.26/61.

Grade 6/7/8, £1,155/£1,780 per annum.

The successful candidate will be based initially at Croydon Generating Station and will be expected to reside within a reasonable distance of his place of work. He will be responsible to the Generation Section

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Head for carrying out automatic control research at Croydon. A knowledge of the operation and design of electrical plant in a generating station is needed and experience in advanced instrumentation techniques would be an advantage.

For Vacancies Nos. 21, 22, 23, 24 and 26 a recognised electrical engineering qualification leading to Corporate Membership of the Institution of Electrical Engineers is desirable and previous research and development experience would be an advantage.

For Vacancy No. 25, qualifications leading to Corporate Membership of the British Institution of Radio Engineers would be acceptable.

ASSISTANT ENGINEERS
ELECTRICAL BRANCH (FOUR VACANCIES)
Vac. No. S.E.27/61.

Grade 9/10/11, £905/£1,460 per annum.

The successful applicants should have similar though not such wide experience as that required for Vacancies Nos. 22, 23, 24 and 26 above. They will also be required to assist in the preparation and construction of electrical equipment and in carrying out tests in the laboratory and in the field. The work will be of an interesting and varied nature.

Applicants should preferably have a recognised electrical engineering qualification and experience in the use and calibration of electronic and electrical instruments and equipment would be an advantage.

ASSISTANT ENGINEER
ELECTRICAL BRANCH
Vac. No. S.E.28/61.

Grade 9/10/11, £905/£1,460 per annum.

The successful applicant will assist generally in the work of the electrical branch and an opportunity will be given to gain experience with a variety of projects. Promotion prospects are good and applicants should have a Higher National Certificate in electrical or electronic engineering and a University Degree would be an advantage.

Applications stating age, qualifications, experience, etc., should be addressed to the Regional Secretary, Ergon Hse, Horseferry Rd, London S.W.1, so as to arrive by not later than 27 June, 1961. (B 152)

HUNTINGDONSHIRE TECHNICAL INSTITUTE

REQUIRED for September, 1961:

GRADE A ASSISTANT

to teach Electrical Installation Work to City and Guilds Final Standard. Applicants should hold C. and G. Final Certificate in Electrical Installation Work or O.N.C. (Elec.). A sound knowledge of the I.E.E. regulations is essential.

The applicant must have had at least five years' industrial experience of Electrical Contracting or Electricity Supply in a supervisory post.

Forms of application and further details are obtainable from the undersigned to whom it should be returned within 14 days of the appearance of this advertisement.

I. C. CURREY,
Director of Education.

Gazeley Hse,
Huntingdon. (B 144)

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Project Group

GENERAL ASSISTANT ENGINEER
(DRAWING OFFICE)—MECHANICAL

APPLICATIONS are invited for appointment as General Assistant Engineer (Drawing Office) (Mechanical), in the Midlands Project Group's Drawing Office, at Bournville, Birmingham.

Candidates should possess a sound practical and technical training and should preferably be fully qualified. The salary will be within the range £650/£1,090 per annum, in accordance with the National Joint Board Agreement.

Applications should be made on standard form AE.6, available from the Administrative Officer, Midlands Project Group, P.O. Box 314, Birmingham 30, and should be returned to him not later than 26 June, 1961.

Envelopes should be marked "Confidential" quoting Staff Vacancy No. MPG.41/61. (B 154)

SOUTH OF SCOTLAND ELECTRICITY BOARD

APPLICATIONS are invited for the undernoted superannuable appointments at Hunterston Nuclear Generating Station, presently under construction, near Largs, Ayrshire.

(1) MECHANICAL MAINTENANCE ENGINEER
(Ref. G17/61)

(2) ELECTRICAL MAINTENANCE ENGINEER
(Ref. G18/61)

The successful candidates will be directly responsible to the Maintenance Superintendent for all maintenance of mechanical and electrical plant at the Station. Candidates should have served a recognised apprenticeship and have had experience in organising and carrying out maintenance programmes. Minimum technical qualifications required will be Higher National Certificate. Specialised nuclear training will be arranged for successful candidates.

Salary: N.J.B. Class M, Grade 6, £1,650/£1,830 per annum.

Applications, quoting appropriate reference, should be submitted on the standard form to the Secretary, South of Scotland Electricity Board, Inverlair Ave, Glasgow S.4, not later than 23 June, 1961. (B 109)

CENTRAL ELECTRICITY GENERATING BOARD

South Thames Division

ELECTRICAL ENGINEER'S DEPARTMENT

FOURTH ASSISTANT ENGINEER
(PROTECTIVE GEAR)

DIVISIONAL HEADQUARTERS, KINGSTON
Vacancy No. 136A/61.

CANDIDATES must possess the Higher National Certificate in Electrical Engineering or equivalent qualification leading to Graduate Membership of the Institution of Electrical Engineers, and should be interested in the application and operation of automatic protective gear on a large power system.

Some knowledge of fault current calculations is very desirable.

Salary: N.J.B. Class AX, Grade 11, £940/£1,140 per annum, including London Allowance and subject to review, with prospects of promotion subject to satisfactory service.

Applications giving age, details of experience, qualifications, present position, etc., should be sent to the Personnel Officer, Central Electricity Hse, Lower Ham Rd, Kingston upon Thames, Surrey, to arrive by 22 June. (B 117)

UNIVERSITY COLLEGE OF THE WEST INDIES

APPLICATIONS are invited for

SENIOR LECTURESHIP IN
ELECTRICAL ENGINEERING

from candidates with interest in Electronics. Salary scale: £1,500 x £75—£2,425 p.a., plus local allowance of £250 p.a. (pensionable). Entry point according to qualifications and experience. Child allowance. F.S.S.U. Unfurnished accommodation at rental of 10% of basic salary. Up to five full passages on appointment, normal termination and triennial study leave. Duties to be assumed as soon as possible. Detailed applications (six copies), naming three referees by 15 July, 1961, to Secretary, Inter-University Council for Higher Education Overseas, 29 Woburn Sq, London W.C.1, from whom further particulars may be obtained. (B 157)

HUNTINGDONSHIRE TECHNICAL INSTITUTE

A LABORATORY STEWARD

REQUIRED for September, 1961. Applicants should be suitably qualified—C. and G. Lab. Tech. and/or O.N.C. (Elec. or Mech. or App. Physics). Duties comprise responsibility for equipment and assisting with experimental work. Salary in accordance with Miscellaneous Grade III, at present £555/£625.

Application forms may be obtained from the undersigned and should be returned within 14 days of the appearance of this advertisement.

I. C. CURREY,
Director of Education.

Gazeley Hse,
Huntingdon. (B 145)

SOUTH EASTERN ELECTRICITY BOARD

DISTRICT ENGINEER
SUTTON DISTRICT

THE appointment will be made at N.J.B. Class G, Grade 3, £1,440/£1,610 p.a. with progression to Grade 2 (maximum salary £1,720), subject to satisfactory service, plus London allowance. Some 76,800 consumers, mainly domestic, are contained in the district, which comprises parts of densely developed Metropolitan Surrey and pleasant rural and urban countryside. The position requires an experienced engineer who should preferably be a corporate member of the Institution of Electrical Engineers, with ability to organise and control all aspects of the work of a distribution department. Consideration will be given to a car allowance and assistance in house purchase in appropriate circumstances.

Applications, quoting ET, on forms obtainable from Surrey Manager, Seeboard, Rough Rew, Ridgeway Rd, Dorking, Surrey, by 28 June, 1961.

FIRST ASSISTANT DISTRICT COMMERCIAL ENGINEER
TWICKENHAM AND RICHMOND DISTRICT

Salary Scale: N.J.B. Class G, Grade 5, £1,275/£1,410 p.a. plus London Allowance, with progression to Grade 4 (maximum salary £1,500) subject to satisfactory service.

The post, which has become vacant through the promotion of the holder to the position of district commercial engineer in another Surrey district, offers an excellent opportunity for acquiring valuable experience in a thriving suburban area. Applications are invited from capable and energetic men with good experience in a commercial department, preferably including sales activities, contracting, tariff negotiations and load development. The possession of an H.N.C. in electrical engineering or its equivalent will be considered an advantage. Consideration will be given to a private car allowance and assistance in house purchase in appropriate circumstances.

Applications, quoting ET, on forms from District Manager, Seeboard, 42 York St, Twickenham, Middlesex, by 28 June, 1961.

ASSISTANT DISTRICT ENGINEER
CROYDON AND PURLEY DISTRICT

Salary: £1,165/£1,295 per annum, including London Allowance under N.J.B. Agreement Class J, Grade 9. Superannuable. Applicants should be suitably qualified and have operational experience of maintenance and construction on distribution system up to 11 kV. Candidates should also have experience of planning work. Applications, quoting ET and naming two referees, on forms from District Manager, Seeboard, Electric Hse, Wellesley Rd, Croydon, by 28 June, 1961.

ASSISTANT DISTRICT ENGINEER
SUTTON DISTRICT

Salary: £825/£940 p.a., plus London Allowance under N.J.B. Class G, Grade 11. Superannuable. Applicants should possess as a minimum qualification the O.N.C. in electrical engineering and should preferably have had practical experience in underground and overhead distribution systems. Applications, quoting ET, on forms from District Manager, Seeboard, 52 High St, Sutton, by 28 June, 1961.

ASSISTANT DISTRICT ENGINEER
MAIDSTONE DISTRICT

Salary under N.J.B. Class F, Grade 9, £890 x £25—£1,015 p.a. Superannuable. Applicants should have had a good general education, be technically trained to H.N.C. standard and have had practical experience in general distribution work on H.V. and L.V. systems. Knowledge of the preparation of system extension and reinforcement proposals an advantage. Applications, quoting ET and naming two referees, to District Manager, Seeboard, Fairmeadow, Maidstone, by 28 June, 1961.

JUNIOR ASSISTANT ENGINEER
(COMMERCIAL)
TUNBRIDGE WELLS DISTRICT

The duties of this post will be of a general nature, and preference will be given to applicants who are studying for or have

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completed the H.N.C. course. Salary under N.J.B. Class F, Grade 12, £715/£805 p.a.

Applications, quoting ET and naming two referees, to District Manager, Seeboard, Town Hall, Tunbridge Wells, by 28 June, 1961.

ASSISTANT DISTRICT ENGINEER
CRAWLEY AND HORSHAM DISTRICT

Salary within the range £890/£1,015, Class F.9. Applicants should be suitably qualified and have had training and experience in the construction, operation and maintenance of underground and overhead distribution systems up to 11 kV. The successful applicant will be required to reside within the district and undertake standby duties. Subject certain conditions, housing accommodation may be available at Crawley.

Applications, quoting ET and naming two referees, to District Manager, 50-52 The Broadway, Crawley, Sussex, by 28 June, 1961.

GEORGE WRAY,
Secretary.
(B 176)

THE EAST MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited from suitably qualified and experienced persons for the following appointments. Applicants should state age, qualifications, experience, etc., and quote the appropriate Vacancy Number.

Northamptonshire Sub-Area

FIRST ASSISTANT DISTRICT COMMERCIAL ENGINEER
KETTERING DISTRICT
Vacancy No. 66/61.

Salary: N.J.B. Class G, Grade 5, £1,275/£1,410 per annum, with progression to Grade 4.

The person appointed will assist the District Commercial Engineer in the supervision of the district commercial activities. The duties will include negotiations for the supply of electricity to agricultural, commercial and industrial consumers, sales activities, contracting and general development.

Candidates should have a sound knowledge of the Electricity Supply Industry, together with good technical and commercial experience.

The possession of an appropriate technical qualification would be an advantage.

Applications should be forwarded to the Manager, Northamptonshire Sub-Area, 25 Bridge St, Northampton, by 30 June, 1961.

Nottingham Sub-Area

SECOND ASSISTANT DISTRICT ENGINEER
Re-advertised Vacancy No. 40/61.

Salary: N.J.B. Class G, Grade 7, £1,115/£1,245 per annum.

The duties will include Construction, Maintenance and Operation on distribution systems of all voltages up to and including 33 kV.

Ability to drive a car is essential and the successful applicant will be required to undertake standby duty.

Applications should be forwarded to the Manager, Nottingham Sub-Area, 35-39 Carrington St, Nottingham, by 30 June, 1961.

Coventry Sub-Area

SECOND ASSISTANT COMMERCIAL ENGINEER
(CONTRACTING)
Vacancy No. 67/61.

Salary: N.J.B. Class L, Grade 8, £1,350/£1,500 per annum.

The duties will include the supervision of a Contracting Section carrying out lighting, heating and power installations, including water heating, in all classes of domestic, commercial and industrial premises.

Applicants must have had extensive experience in the preparation of schemes and quotations for all types of installations and must be thoroughly conversant with all aspects of off-peak space heating practices.

The possession of an appropriate technical qualification would be an advantage.

Applications should be forwarded to the Manager, Coventry Sub-Area, Sandy La, Coventry, Warwickshire, by 30 June, 1961.
(B 168)

SOUTHERN RHODESIA

City of Salisbury Electricity Department

THE following two vacancies occur in the above Undertaking's fixed establishment and accordingly applications are invited from those suitably qualified:

SENIOR ELECTRICAL ENGINEER
(INSTALLATION)

Salary: £1,768 2s 6d x £51 5s—£1,921 17s 6d p.a.

Candidates must be corporate members of the British Institution of Electrical Engineers and/or hold an equivalent engineering degree.

The post requires experience in the general application of electricity to industrial, commercial and domestic premises, the preparation of estimates for the planning of such installations, general knowledge of Electricity Regulations and commissioning and maintenance of electrical plant and installations. The successful candidate will serve in the Consumers' Engineer's Section as assistant to the Installation Engineer.

Commencing salary will be at the minimum of the grade. No cost of living or other allowances are payable.

ELECTRICAL ENGINEER (PROTECTION)

Salary: £1,025 x £102 10s—£1,332 10s x £76 17s 6d—£1,563 2s 6d x £51 5s—£1,768 2s 6d.

Candidates must be graduates of the British Institution of Electrical Engineers and/or hold an equivalent electrical engineering degree and have had experience in general protection work.

Consideration, however, will be given to applicants who have not the above qualifications but who have had extensive practical experience.

The salary scale in the case of a candidate being appointed who falls within this latter category will be £1,568 5s x £51 5s—£1,722 per annum, but should it be a qualified candidate then the commencing salary will be dependent upon his qualifications and experience. There is a barrier at £1,563 2s 6d per annum above which an Engineer cannot rise without being a corporate member of the British Institution of Electrical Engineers. The maximum entry point into the grade is £1,614 7s 6d per annum.

The successful applicant will work under the direction of the Test Engineer in the Consumers' Engineer's Section and his duties will comprise mainly:

1. Design and commissioning of all types of protection schemes on generators, feeders, motors, transformers and other types of electrical equipment.
2. Determination of relay settings and the calculation of fault currents over the system.
3. Supervision of staff engaged in the maintenance and repair of all relays and instruments associated with protection schemes.

The Department has an extensive supervisory indication, control and telemetering scheme and experience with similar equipment would be considered an advantage.

GENERAL

Both these appointments will be subject to the City Council's Service and Leave Regulations.

Successful candidates will be required to furnish to the Council a satisfactory medical certificate of fitness and to serve a probationary period of not less than six months and if thereafter confirmed in their respective appointments to join the Southern Rhodesia Local Authorities Joint Pension and Widows and Orphans Fund.

Candidates must submit full particulars of their qualifications, training and experience giving details of positions held and salaries received. Age, nationality and marital state should be stated and copies of not more than three recent testimonials may be forwarded.

Particulars of the undertaking and a summary of conditions of service, pension and leave entitlements, etc., may be obtained from Messrs. Merz and McLellan, Carliol Hse, Newcastle upon Tyne, 1, to whom applications must be submitted on or before 7 July, 1961. (B 161)

CENTRAL ELECTRICITY GENERATING BOARD
North Eastern and Yorkshire Region
REGIONAL ELECTRICAL DEPARTMENT

APPLICATIONS are invited for the following appointments in the Transmission Project Branch of the Regional Electrical Department based on Leeds.

FOURTH ASSISTANTS (DRAWING OFFICE)
CIVIL AND BUILDING
GRADE 11, CLASS BX (£900/£1,165)

Applicants should have suitable technical training with adequate Drawing Office experience and be thoroughly conversant with the design and detailing of civil and building works, including Reinforced Concrete Structures and Foundations.

FOURTH ASSISTANTS (DRAWING OFFICE)
ELECTRICAL SUBSTATIONS
GRADE 11, CLASS BX (£900/£1,165)

Applicants should have suitable technical training and Drawing Office experience in the layout of indoor and outdoor (275 and 132 kV) substations, schematics, wiring diagrams and the preparation of cables schedules and layouts.

FOURTH ASSISTANTS (DRAWING OFFICE)
OVERHEAD LINES AND CABLES
GRADE 11, CLASS BX (£900/£1,165)

Applicants should have a sound knowledge and experience in Overhead Line profile plotting, situation of towers, calculations and building clearance drawings, etc., for 275 kV and 132 kV Transmission Lines.

GENERAL ASSISTANTS (DRAWING OFFICE)
CIVIL
GRADES 15-18, CLASS BX (£625/£870)

Applicants should have adequate training and Drawing Office experience suitable for detailing of civil and building works, including Reinforced Concrete Structures and Foundations.

GENERAL ASSISTANTS (DRAWING OFFICE)
ELECTRICAL
GRADES 15-18, CLASS BX (£625/£870)

Applicants should have adequate training and Drawing Office experience suitable for preparing 275 kV and 132 kV substation layouts and associated wiring diagrams, etc.

Forms of application may be obtained from the Assistant Regional Secretary (Personnel), Central Electricity Generating Board, North Eastern and Yorkshire Region, 1 Whitehall Rd, Leeds 1, to whom they should be returned stating the appointment applied for to arrive not later than 30 June, 1961. (B 164)

QUEEN MARY COLLEGE
University of London

APPLICATIONS are invited for
TWO LECTURESHIPS IN
ELECTRICAL ENGINEERING

One post is for an engineer or physicist with experience of laboratory techniques associated with research on dielectrics and semiconductors who will be concerned with the development of a newly completed materials laboratory. The other is for an engineer or mathematician with experience in the design of control systems or the use of digital computers in engineering analysis to join a systems engineering group with good facilities for digital computation. Salary scale: £1,050 x £50—£1,400 x £75—£1,550 (efficiency bar) x £75—£1,850, plus London Allowance of £60. Tenable from 1 Oct., 1961 Initial salary according to qualifications and experience, with F.S.S.U. participation and family allowance of £50 for each child. Application forms, obtainable from the Registrar, Queen Mary College, Mile End Rd, E.1, to be returned by 26 June, 1961. (B 135)

SOUTH OF SCOTLAND ELECTRICITY BOARD
Lanarkshire Area

APPOINTMENT OF SECOND ASSISTANT
DISTRICT ENGINEER
(LANARK DISTRICT)

APPLICATIONS are invited for the appointment of Second Assistant District Engineer in Lanark District. Applicants should possess recognised technical qualifications and have had a sound engineering training. They should have had subsequent experience in the maintenance and operation of H.V. and L.V. overhead and underground networks and of H.V. substations on a large distribution system. They should also be conversant with load flow diagrams, voltage drop and short-circuit calculations and should have experience on H.V. fault location.

The Salary and Conditions of Service for the appointment will be in accordance with the National Joint Board Agreement, the present classification and grading being E.7, Salary: £965/£1,090 per annum.

Application forms, which may be had from the Area Manager, Montrose Cres, Hamilton, should be returned to this office within 14 days of the date of this advertisement. (B 167)

SOUTH EAST METROPOLITAN REGIONAL HOSPITAL BOARD

APPLICATIONS invited for posts of
ENGINEERING DRAUGHTSMEN
(ELECTRICAL)

from those interested in designing engineering services for new hospitals, extensions, etc. Those appointed will work in teams under the general control of experienced professional engineers and normally be engaged on the preparation of tender drawings and specifications.

Salary Scales: Draughtsmen, Grade I, £1,080/£1,300; Grade II, £910/£1,060; Grade III, £560/£890.

Commencing salary is at the minimum, except in Grade III where age and experience are taken into consideration.

Applicants for Grade I and Grade II posts should preferably have the Higher National Certificate in Electrical Engineering, or equivalent qualification, but applications will be considered from those who have the necessary experience without having passed these examinations. Applicants for Grade III posts should have had three years' practical and theoretical training and be desirous of entering the field of design as distinct from installation on site work.

Applications stating age, qualifications, experience, present appointment and salary, with names and addresses of two referees, should reach the Secretary, 40 Eastbourne Terr, W.2, by 27 June. (B 146)

CENTRAL ELECTRICITY GENERATING BOARD
Southern Division

STATION CHEMIST
POOLE GENERATING STATION
SEC/3.155.

APPLICANTS should be fully qualified industrial chemists and have had practical experience of fuel, oil and water testing and boiler chemistry associated with high temperatures and pressures.

The successful applicant will be required to control ion-exchange plant and to deal with fouling problems arising from (a) oil firing and (b) marine life in culverts.

Salary: N.J.B. K.6, Scale 13, £1,440/£1,610.

Special application forms, obtainable only from Divisional Secretary, 111 High St, Portsmouth, should be returned by 27 June, 1961. (B 169)

TEST ENGINEER

required for commissioning H.V. and L.V. Cable Installations, Switchgear, Transformers, etc. Qualified Engineer preferred, but unqualified man with good field experience would be considered. London based, superannuation scheme. Reply full details, salary required, to Box No. 8327, Electrical Times. (B 138)

BRUSH

Brush Electrical Engineering Company Limited
(A member of the Hawker Siddeley Group—Industrial Division)

DRAUGHTSMEN

Transformer
Switchgear
Rotating Electrical Machines
Motor Control Gear
Electric and Diesel Electric Locomotives
(Mechanical, Control Gear & Electrical Machines)
General Engineering

If you are a qualified Draughtsman and interested in one of the above vacancies, please apply to:

Mr. A. Garner,
Brush Electrical Engineering Company Limited,
Loughborough, Leicestershire,

quoting reference PL.9943, and giving brief details of your qualifications and experience.

ALL APPLICATIONS WILL BE TREATED IN THE STRICTEST CONFIDENCE.

The Company is situated in a small town on the edge of Charnwood Forest. Extensive housing development is taking place and excellent educational facilities of all grades are available.

(B 25)

GLIKSTEN (WEST AFRICA) LTD.,
Carpenters Rd, Stratford,
London E.15

require an

ASSISTANT ENGINEER (ELECTRICAL)

for a permanent and pensionable appointment in Ghana. Candidates should be between 25 and 31 years of age, have served a recognised apprenticeship, preferably in factory electrical maintenance, and have in addition a minimum of three years' practical experience.

They should also possess at least an Ordinary National Certificate (Electrical).

Please write with full particulars to the Personnel Officer.

(B 142)

CENTRAL ELECTRICITY GENERATING BOARD
South Western Division
Vacancy Notice: ET/AV/58/61.
GENERAL ASSISTANT ENGINEER

REQUIRED at Portishead "B" Power Station.

Superannuation Scheme. Salary: N.J.B. Class K, Grade 15, Scale 4, £765/£870 per annum.

Possession of, or at present studying for, a Higher National Certificate or similar qualification, would be an advantage.

Applications on Form AE6/ACT, obtainable from the Divisional Secretary, 26 Oakfield Rd, Bristol 8, should be completed and returned by 26 June, 1961. (B 172)

YORKSHIRE ELECTRICITY BOARD
No. 4 (Leeds) Sub-Area
SECOND ASSISTANT ENGINEER
(CONSTRUCTION)

DUTIES will include the design and construction of indoor and outdoor substations operating at voltages up to 66 kV and negotiations with plant manufacturers.

Applicants should have an all round general knowledge of substation plant and experience of field construction.

Salary: N.J.B. Class L, Grade 7 (Scale 13), £1,440/£1,610 per annum.

Applications, together with the names of two referees, should be sent to the Manager, Yorkshire Electricity Board, No. 4 (Leeds) Sub-Area, Bramhope, nr. Leeds, not later than 30 June, 1961. (B 173)

A leading Midlands manufacturer of electric wiring accessories seeks a SENIOR DESIGNER having specialised experience in this field, for which an appropriate salary will be paid. Position offers adequate scope for initiative and originality under congenial working conditions with all usual benefits. Holiday arrangements will be honoured.

Replies will be treated with absolute confidence. Box No. 8325, Electrical Times.

(B 129)

GOVERNMENT OF ADEN
Public Works Department
ELECTRICAL AND MECHANICAL ENGINEER

QUALIFICATIONS: Candidates must be A.M.I.Mech.E. or A.M.I.E.E. with ten years' extensive experience in electrical and mechanical engineering.

Duties: To take charge of the electrical and mechanical branches of the Department and to advise the Director of Public Works on technical matters in those spheres.

Terms of Appointment: Contract for 18-24 months. Salary at appropriate point in scale £1,232/£2,004. The salary scales are expected to be increased in the near future following the report of a Salaries Commission. Gratuity. Children's allowances. Free passages. Outfit allowance. Married quarters available at moderate rental. Generous home leave.

Write Director of Recruitment, Colonial Office, London S.W.1, giving full names, age, qualifications and experience, and quoting BCD 112/2/018/D10. (B 143)

PILKINGTON BROTHERS LIMITED

require an

ELECTRICAL ENGINEER

to take charge of the High Voltage Laboratory comprising power frequency and impulse test sections with test voltages of up to 1,300 kV and 2,000 kV, respectively. An intensive programme of research and development relating to toughened glass power line insulators is in progress.

Applications stating age, qualifications, experience and present salary should be addressed to the Personnel Officer (Graduate Recruitment), Pilkington Brothers Limited, St. Helens, Lancashire.

(B 137)

ADMINISTRATIVE COUNTY OF LEICESTER
ASSISTANT ELECTRICAL ENGINEER
£960/£1,310

CANDIDATES must be Associate Members of the Institution of Electrical Engineers or be in possession of the Higher National Certificate and be experienced in the design of electrical installations for all types of buildings. Removal expenses and lodging allowance may be paid to a married man. Apply on form available from the County Architect, 123 London Rd, Leicester. (B 10)

GOVERNMENT OF NORTHERN RHODESIA
Ministry of African Education
TECHNICAL MASTER
(ELECTRICAL INSTRUCTOR)

REQUIRED, either (a) with prospects of admission to permanent and pensionable establishment or (b) on temporary terms for one tour in first instance with generous gratuity. Initial tours are for three years. Commencing salary according to age and experience in scale rising to £1,720 a year. Free passages. Liberal leave on full salary.

Candidates, between 24 and 35 years of age, must possess C. and G. Final Certificate in Electrical Installation Work or equivalent. Successful candidate will be required to teach African students up to C. and G. Final Certificate standard.

Apply to CROWN AGENTS, 4 Millbank, London S.W.1, for application form and further particulars, stating age, name, brief details of qualifications and experience and quoting reference M2A/51334/EE. (B 141)

DESIGNER DRAUGHTSMAN

Required for interesting work on Lighting Fittings, mainly fluorescent. Must have sound knowledge of engineering principles and be capable of original thought. The work requires a knowledge of modern manufacturing methods including pressure die casting, injection and compression moulding and extrusion of plastics, sheet metal fabrication and electrostatic painting.

Superannuation, canteen facilities, excellent working conditions. Apply to Personnel Officer, Crompton Parkinson (Doncaster) Ltd., Wheatley, Doncaster.

(B 181)

N.I.R.N.S.

National Institute For Research In Nuclear Science

have the following vacancies at the Rutherford High Energy Laboratory now under construction adjacent to A.E.R.E. Harwell, Berks.

TECHNICAL STAFF are required to fill several posts in a group concerned with the operation of a Proton Linear Accelerator which is being used in the Laboratory's Research programme. The successful candidates will act as assistant operators and the posts will involve shift working. A sound basic training in electrical engineering is required together with some experience in the operation and fault analysis of electrical or electronic plant. The possession of an appropriate National Certificate would be an advantage. The salary is within the scale £885/£1,060 according to age and experience, with annual increments to the maximum of scale. An additional shift allowance is also payable.

There is a contributory superannuation scheme, transport facilities are available and assistance is given with housing. If you are interested in joining this new organisation then please send a postcard for further details to:

Personnel Officer

RUTHERFORD HIGH ENERGY LABORATORY, HARWELL, BERKSHIRE

(quoting Ref. Number V.N. 63/49)

(B 180)

SOUTH OF SCOTLAND ELECTRICITY BOARD
Stirling Area

APPLICATIONS are invited for the undernoted appointment:

GENERAL ASSISTANT ENGINEER
Vacancy 28/61)

for the Falkirk District of this Area.

Applicants should have experience of high and medium voltage electricity supply distribution systems and should possess, at least, the Ordinary National Certificate in Electrical Engineering.

N.J.B. conditions. Salary: Class G, Grade 12, £765/£870 per annum.

The post is superannuable, subject to satisfactory evidence of good health.

Applications, on the standard form, obtainable from the Area Manager, S.S.E.B., "Woodlands," St. Ninians Rd, Stirling, should be submitted not later than 26 June, 1961. (B 170)

CENTRAL ELECTRICITY GENERATING BOARD
Southern Project Group

WEST THURROCK POWER STATION

APPLICATIONS are invited from suitably qualified engineers for the post of

SECOND ASSISTANT ENGINEER
(ELECTRICAL)

at West Thurrock Power Station Construction Site.

The successful candidate will be required to assist the Site Electrical Engineer in the supervision of the installation and testing of electrical engineering plant. Experience on a power station construction site or of the installation of major electrical works would be an advantage.

Applicants should preferably be members of the Institution of Electrical Engineers or possess qualifications leading to membership.

The salary will be within Scale 15 of the National Joint Board Agreement, i.e., £1,460/£1,830 per annum, plus £60 London Allowance, according to qualifications and experience.

Applications, stating age, qualifications, experience, present position and salary, should be forwarded to the Administrative Officer, Central Electricity Generating Board, Southern Project Group, Squires La, Finchley, N.3, to arrive not later than 26 June, 1961.

Envelopes should be marked "Confidential—ref. S/61/11."

T. YULE,
Chief Project Engineer.
(B 163)

CENTRAL ELECTRICITY GENERATING BOARD
East Midlands Division

GENERAL ASSISTANT ENGINEER
CASTLE DONINGTON POWER STATION
Vacancy No. 128/61.

APPLICATIONS are invited for the position of General Assistant Engineer at Castle Donington Power Station, Castle Donington, nr. Derby.

Duties will include operation, planning and general plant investigation work.

Preference will be given to applicants holding or taking a Higher National Certificate in Electrical or Mechanical Engineering.

The salary will be within Class L, Grade 15 (£825/£940 per annum), of the National Joint Board Agreement.

Closing date for receipt of applications: 23 June, 1961.

GENERAL ASSISTANT ENGINEER
HIGH MARNHAM POWER STATION
Vacancy No. 131/61.

Applications are invited for the position of General Assistant Engineer at High Marnham Power Station, nr. Newark, Notts.

Preference will be given to candidates who hold the Higher National Certificate or who are at present pursuing a course of study with the object of obtaining this or a similar qualification.

Salary will be in accordance with Class N, Grade 17 (£825/940 per annum), of the National Joint Board Agreement.

Closing date for receipt of applications: 23 June, 1961.

ASSISTANT SHIFT CHARGE ENGINEER
COVENTRY POWER STATION
Vacancy No. 135/61.

Applications are invited for the position of Assistant Shift Charge Engineer at Coventry Power Station, Alderman's Green, Coventry.

continued in next column

continued from previous column

Applicants are required to take charge of shift operation of boiler house plant and must possess a sound technical training, a good general engineering experience, and knowledge of the control and operation of water tube boilers, ancillary plant and the efficient combustion of chain grate stokers.

Salary will be in accordance with Class G, Grade 9 (£965/£1,090 per annum), of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications: 30 June, 1961.

SHIFT CHARGE ENGINEER
SPONDON POWER STATION
Vacancy No. 136/61.

Applications are invited for the position of Shift Charge Engineer at Spondon Power Station, Thulston Rd, Borrowash, nr. Derby.

Applicants should have had a sound training and considerable experience in a modern generating station.

Preference will be given to candidates who are Graduate Members of the Institution of Electrical or Mechanical Engineers, or who hold similar qualifications.

Salary will be within Class J, Grade 6 (£1,350/£1,500 per annum), of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications: 30 June, 1961.

ASSISTANT PLANNING ENGINEER
NORTH WILFORD POWER STATION
Vacancy No. 137/61.

Applications are invited for the position of Assistant Planning Engineer at North Wilford Power Station, Queen's Drive, Nottingham.

Applicants should have held a position of responsibility in a modern power station and should have received a thorough practical and theoretical training.

Preference will be given to candidates who are Corporate Members of a recognised professional institute or who hold qualifications leading to such membership, and candidates should have a clear and objective approach to power station planning problems.

Salary will be in accordance with Class K, Grade 8 (£1,275/£1,410 per annum), of the National Joint Board Agreement.

Closing date for receipt of applications: 30 June, 1961.

MAINTENANCE ENGINEER (MECHANICAL)
NORTH WILFORD POWER STATION
Vacancy No. 138/61.

Applicants should be suitably qualified and have received a sound technical training with practical experience in the maintenance of power station mechanical plant.

Preference will be given to candidates who are associated members of a recognised Institute or possess similar qualifications.

Salary will be in accordance with Class K, Grade 6 (£1,440/£1,610 per annum), of the National Joint Board Agreement.

Closing date for receipt of applications: 30 June, 1961.

MAINTENANCE ENGINEER (ELECTRICAL)
NORTH WILFORD POWER STATION
Vacancy No. 139/61.

Applicants should have received a thorough technical and practical training followed by considerable experience in testing and protective gear, maintenance of alternators, transformers, switchgear and associated equipment and be capable of taking control of electrical maintenance staff.

Preference will be given to candidates who are associated members of a recognised Institute or who possess similar qualifications.

Salary will be in accordance with Class K, Grade 6 (£1,440/£1,610 per annum), of the National Joint Board Agreement.

Closing date for receipt of applications: 30 June, 1961.

These appointments are pensionable within the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT which may be obtained from the Station Superintendent concerned and returned to him by the specified date.

O. S. WOODS,
Divisional Controller.
(B 177)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

CONTRACTING ENGINEERS

REQUIRED in the St. Helens and Runcorn Districts of the Board's No. 2 Sub-Area. The salary for the St. Helens post is within range £1,040/£1,165 per annum (N.J.B. H.9), and for the Runcorn District £965/£1,090 per annum (N.J.B. G.9).

Applicants must have served a recognised apprenticeship, and have experience of all types of electrical installation work, including estimating and supervision of work on site. Sound technical training is essential, and the possession of a technical qualification would be an advantage.

Appointments subject to medical examination. Pension Scheme.

Application forms obtainable from the Manager, No. 2 Sub-Area, Sandiway Hse, Northwich, Cheshire. Closing date: 29 June, 1961. (B 174)

Eastern Electricity
Essex Sub-Area

FOURTH ASSISTANT ENGINEER
(PLANNING AND DEVELOPMENT)
SUB-AREA HEADQUARTERS
140/61.R.

CANDIDATES should have had a sound technical training and experience in the planning, construction, operation and maintenance of H.V. and L.V. distribution systems.

Salary: N.J.B. Class M, Grade 13 (£1,040/£1,165), plus London Allowance.

Apply by letter to C. C. Brazier, A.M.I.E.E., Engineer, Essex Sub-Area, Eastern Electricity Board, Millfield, Bentley, nr. Brentwood, Essex, by 30 June, 1961.

Fens Sub-Area

SENIOR ASSISTANT ENGINEER
(COMMERCIAL)
SUB-AREA HEADQUARTERS
139/61.R.

Applications are invited from engineers with a wide experience of electrical installations and contracting business, the sale of domestic appliances and commercial equipment, the application of tariffs and the general development of the utilisation of electricity in the Sub-Area.

The post calls for a person with sound commercial sense combined with a lively mind capable of interpreting and pursuing an aggressive general sales policy under the direction of the Sub-Area Commercial Officer. Corporate membership of the Institution of Electrical Engineers would be an added advantage.

Salary: N.J.B. Class K, Grade 4 (£1,650/£1,830).

Apply by letter to Mr F. C. Orchard, J.P., Manager, Fens Sub-Area, Eastern Electricity Board, Milton Hall, Milton, Cambridge, to arrive not later than 23 June, 1961. (B 179)

SOUTHERN ELECTRICITY BOARD

ASSISTANT ENGINEER
(SUBSTATION MAINTENANCE)

PORTSMOUTH District of No. 3 (Portsmouth) Sub-Area. Salary: N.J.B. Class J, Grade 7 (£1,275/£1,410 per annum). N.J.B. Conditions of Service.

The duties of the post will be to assist with the maintenance of plant and equipment at outdoor and indoor substations on both urban and rural systems. Candidates should have had a good technical training, experience of the testing and maintenance of plant and equipment and should possess suitable technical qualifications.

The successful candidate will be required to contribute to the Electricity Supply (Staff) Superannuation Scheme, if eligible.

Applications on forms obtainable from the Sub-Area Secretary, Lower Drayton La, Cosham, Portsmouth, and returned to him, quoting Z.1364, not later than 26 June, 1961. (B 175)

ASSISTANT MANAGER for Electrical Contracting Department. Must have experience of engineering and estimating for medium/large industrial and commercial installations. Apply by letter. Simpson Bros. (c/ Hapton) Ltd., Hapton, Burnley, Lancs. (B 148)

ARMATURE WINDER required with experience of machines up to 100 h.p. Ideal opportunity for young skilled man to establish a permanent position and gain further experience. Apply in writing, giving age, experience, present wages to Works Employment Officer, Fuller Electric Ltd., Fulbourne Rd, Walthamstow, E.17. (B 158)

ASSISTANT ELECTRICAL ENGINEERS with at least H.N.C. and 2/3 years' experience of E.H.V. Transmission Work, required by Consulting Engineers in their Contracts and Design Department, Weybridge. Applications stating age, qualifications, experience and salary required, to Kennedy and Donkin, 12 Caxton St, London S.W.1, quoting ref.: RWMc. (B 90)

ARMATURE WINDERS. Opportunity exists for skilled men for general repairs and rewinds. Expanding dept. of old-established electrical engineers. Pension scheme.—Cox-Walkers Ltd., Feethams, Darlington. (B 101)

CABLE ESTIMATOR required. State age and experience.—Wandleside Cable Works Ltd., 106 Garratt La, Wandsworth, S.W.18. (B 151)

ELECTRICAL DRAUGHTSMAN required by the Guest Keen Iron and Steel Works (Branch of G.K.N. Steel Co. Ltd.), aged 25-30. Applicants should be of H.N.C. standard and have a knowledge of heavy industrial plant. Salary dependent on age and experience. Superannuation scheme, canteen and sports club facilities. Applications in writing to the Labour Manager, Guest Keen Iron and Steel Works, East Moors, Cardiff. (B 35)

ENERGETIC and enthusiastic REPRESENTATIVES required by progressive light Electrical Engineering Company for London, Midlands and North West areas.—Box No. 8333, Electrical Times. (B 160)

EAST AFRICA: ASSISTANT ENGINEER required; must be experienced in estimating and supervision for electrical contracts of all types and values.

Write giving full details to Box No. 8337, Electrical Times. (B 183)

ELECTRICAL CONTRACTING MANAGER required to build up business from scratch for old well-established electrical retailer in Berkshire. Must be capable of estimating, costing and organising. Good salary and a percentage of profits. Write Box No. 8329, Electrical Times. (B 139)

HONG KONG. Merchant Company require qualified Engineer for Sales Department dealing in general electrical and mechanical engineering supplies, including Air-Conditioning Plant, Refrigerators, Cables, Motors, Pumps, etc. B.Sc. or A.M.I.E.E. preferred, sound commercial experience essential. Age 30-35. Good salary plus commission, excellent prospects. Write: Box No. 2030, c/o Abbotts, Eastcheap, London E.C.3. (B 136)

LIGHTING Industry. A well-known Engineering Group will shortly be appointing a REGIONAL SALES MANAGER and TWO SPECIAL REPRESENTATIVES for the Central London headquarters of an associated company engaged in architectural lighting.

These appointments carry substantial salaries and commission and offer prospects of promotion to men capable of leadership and initiative. If you would like further details you should write to the Group Appointments Officer, Box No. 8335, Electrical Times. (B 182)

Box No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London W.C.2

LIGHTING SALES ENGINEER. Experienced man having proven sales record and good connection with users, architects and consultants required in East Midlands area. Short period of training will be given at head office in London, and successful candidate should have some technical experience. I.E.S. Diploma membership advantageous. An opportunity for a youngish man to build his future in a happy old-established organisation. Car provided and expenses. Contributory Pension Fund. Apply, with full details of experience, etc. (marking envelope "Confidential"), to Sales Director, Holophane Ltd., Elverton St, Vincent Sq, Westminster S.W.1. (B 75)

QUALIFIED LIGHTING SALES ENGINEER required immediately in the London Area for specialised work in connection with Schools, Hospitals and municipal projects. Applicants experienced in negotiating with architects, consulting engineers and local authorities should apply in writing, stating age, experience and present salary to: Technical Sales Manager, Atlas Lighting Ltd., Thorn Hse, Upper St. Martin's La, London W.C.2. (B 159)

TECHNICAL ASSISTANT required in Electrical and Mechanical Engineering Section of Chief Engineer's Department, with experience of modern electrical and mechanical installations in large buildings. Experience of heating and ventilating an advantage. Graduate or associate membership of recognised professional body preferred. Up to £960, according to qualifications and experience, with prospects of advancement to higher grades. Pension scheme. One Saturday only worked in five. Form from Chief Engineer (GS/T/1568/6a), L.C.C., County Hall, S.E.1. (B 133)

TRAINEE TRANSFORMER DESIGNER required by Transformer Company dealing with a wide range of transformers and associated equipment for industrial and electronic applications. H.N.C. or O.N.C. preferred. Apply: Chief Engineer, Twickenham Transformers Ltd., Richmond Rd, Twickenham. POP 9142. (B 178)

APPOINTMENTS WANTED

ELECTRICIAN wants position with house. South of England.—Box No. 8331, Electrical Times. (B 140)

PATENTS

THE Proprietors of British Patents Nos 748121 for "PRINTING TELEGRAPH APPARATUS," 748139 for "KEYBOARD TRANSMITTER" and 748140 for "SELECTOR MECHANISM FOR PRINTING TELEGRAPH APPARATUS," desire to enter into negotiations with a firm or firms for the sale of the patents or for the grant of licences thereunder. Further particulars may be obtained from Marks and Clerk, 57 and 58 Lincoln's Inn Fields, London W.C.2. (B149)

THE Proprietors of British Patent No. 770441 for "ELECTRICAL PERMUTATION SELECTOR SWITCH," desire to enter into negotiations with a firm or firms for the sale of the patent or for the grant of licences thereunder. Further particulars may be obtained from Marks and Clerk, 57 and 58 Lincoln's Inn Fields, London W.C.2. (B 150)

WANTED

WANTED for prompt cash, ferrous and non-ferrous SCRAP; also plant for dismantling. Buyers of second-hand machinery and plant for re-use.—W. and H. Cooper Ltd., 17 Brady St, Bethnal Green, E.1. (B 1)

FOR SALE

A.A. ELECTRICAL CO. for A.C.-D.C. MOTORS, Switchgear, Exhaust Fans, Hoists, Reduction Gears, new or reconditioned units.—CHI 5105, 67 Rothschild Rd, W.4. (B 2)

A.C. AND D.C. MOTORS, Generators, new and reconditioned. REWINDS and repairs promptly executed.—Service Electric Co. Ltd., Honeypot La, Stanmore, Middx. Edgware 5566. (B 8)

A.C. AND D.C. SLOTMETERS: Time Switches and Quarterly Meters. Single and polyphase, 2½-100 amps. Tested and guaranteed 2 years. Television and Billiards Meters. — Tradex Meter Co., Surbiton. Elmbridge 2234/5/6. (B 7)

ELECTRIC MOTORS, D.C. and A.C. Motor Generator Sets, Alternators and Dynamos. Diesel Sets, Circuit-breakers, Switchboards, reconditioned and guaranteed. Very large stocks held.—Britannia Manufacturing Co. Ltd., Britannia Walk, N.1. CLErkenwell 5512/3/4. Stores at Chobham, Surrey. (B 5)

FLUORESCENT FITTINGS, Shells and Chokes to BS 2818 (Licence No. 3237) Coil Winding, all sheet metal work.—D. E. Cowling & Sons Ltd., Romside Trading Estate, North St, Romford 47282. (B 9)

HOUSE-SERVICE METERS, all types can be obtained by return from Selectrics, Dept. E.T., Meter Hse, Factory Row, Castle Circus, Torquay. Phone 7218. (B 6)

HOUSE-SERVICE METERS, A.C. or D.C., quarterly or prepayment. — Universal Electrical, 221 City Rd, London E.C.1. (B 3)

PURLEY CHOKES AND BALLASTS. Our 80 W tapped h.p.f. ballast with starter switchgear-holder incorporated is proving itself the most popular unit. Suitable for most fittings, 57s 6d each subject. —F. W. Blanshard Ltd. (Dept. E.T.), Purley, Surrey. Uplands 4818/9. (B 4)

FINANCIAL

A SECOND mortgage our speciality; £2 6s 8d monthly repayment on each £100 borrowed. Also: 100% Deferred Mortgage; 95% Immediate. Business and Investment Finance. Cranbrook Mortgage Bureau, Department C.H.9, 49 Cranbrook Rd. Ilford 3615 (3 lines). (B 55)

EDUCATIONAL

COUNTY BOROUGH OF BOURNEMOUTH

Bournemouth Municipal College of Technology and Commerce

PRINCIPAL: M. L. YATES,
M.A.(COM.), M.SC.TECH., PH.D., M.I.MECH.E.

FULL-TIME and part-time courses are provided in preparation for the following:

- B.Sc. General (Chemistry, Physics, Biology, Mathematics)
- B.Sc. Engineering (Electrical, Mechanical)
- B.Sc. Economics (Accountancy, Government, Industry and Trade)

(University of London External Degrees)

Higher National Diploma Sandwich Course in Mechanical Engineering.

Institution of Electrical Engineers Part III Examination.

Accountancy.

Provision is made for students' social and athletic interests.

Applications for admission should be addressed to the Principal, from whom any further particulars required, may be obtained. Telephone: Bournemouth 20844. (B 153)

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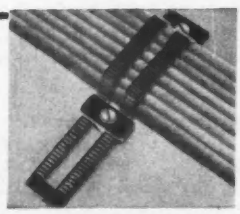

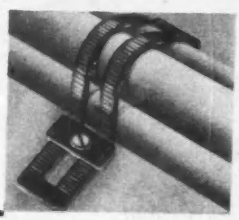

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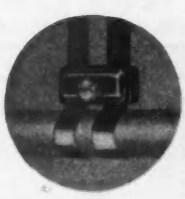

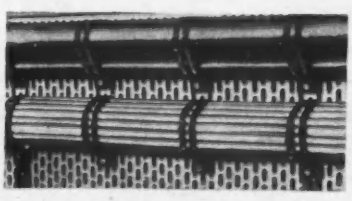

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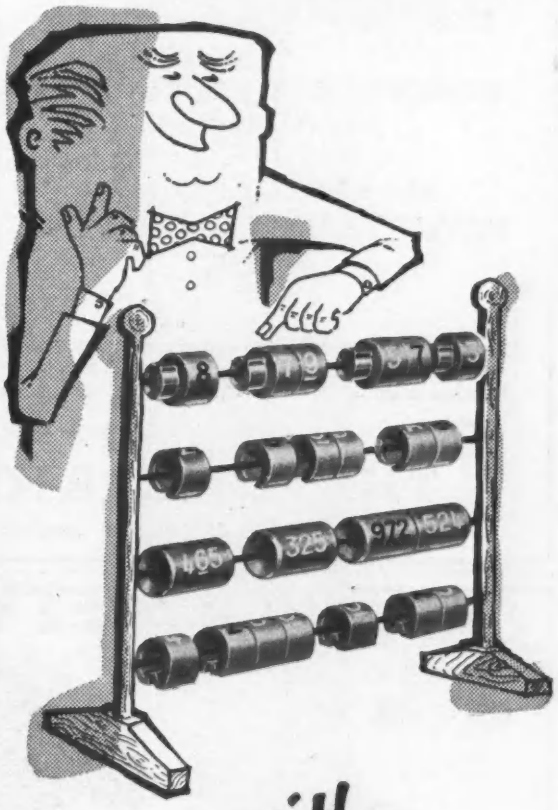

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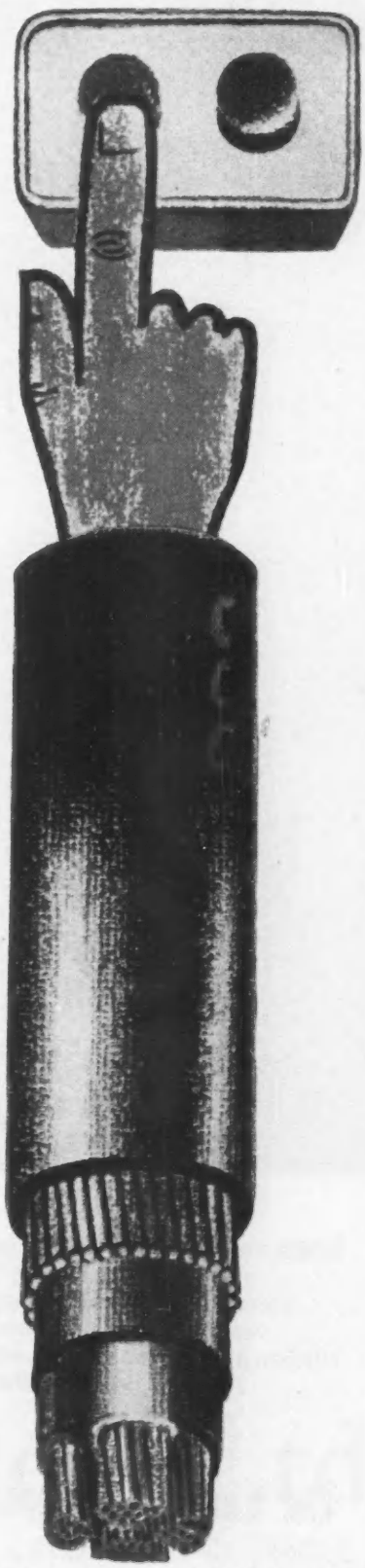

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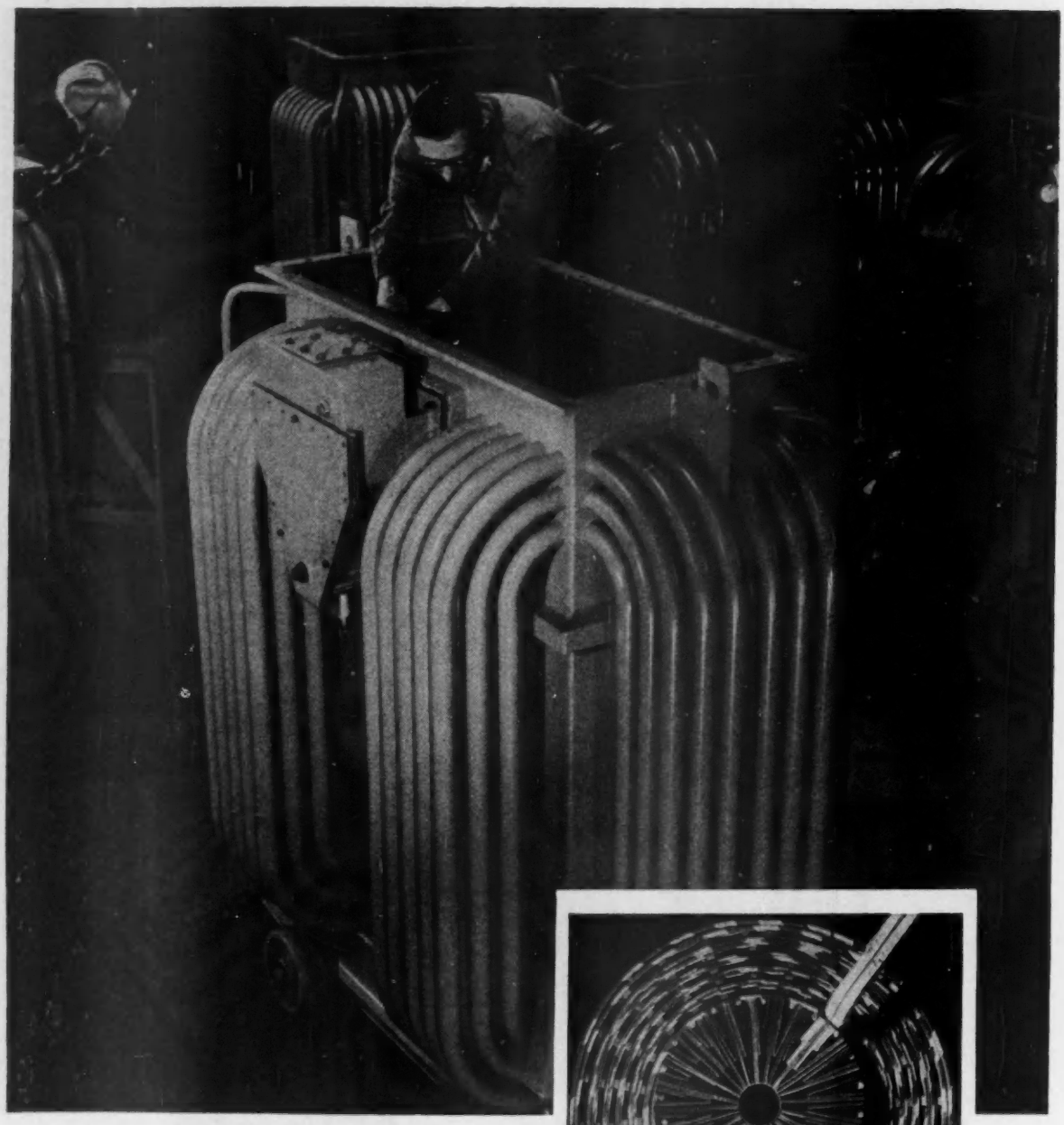

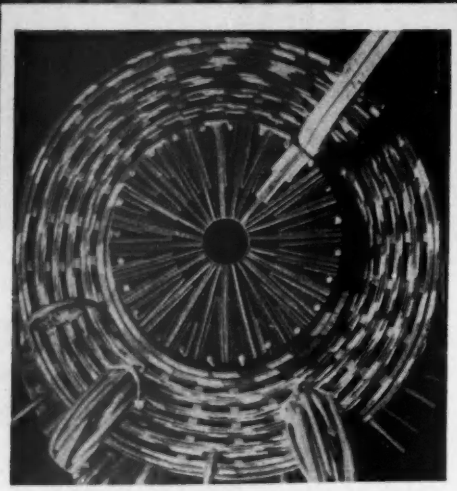

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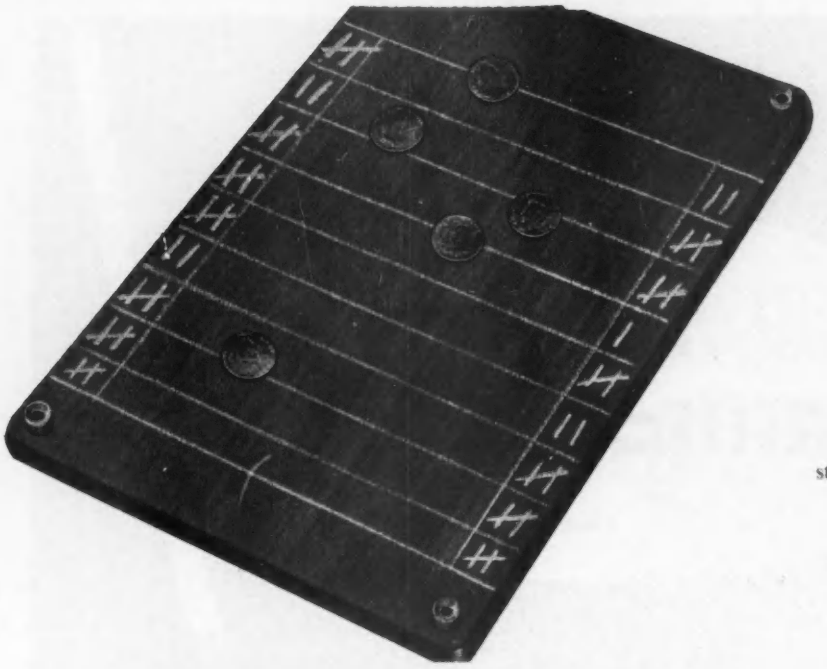

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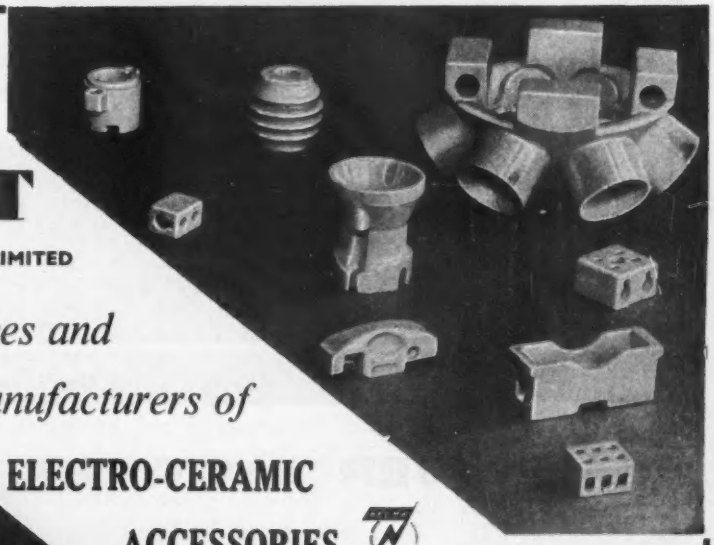

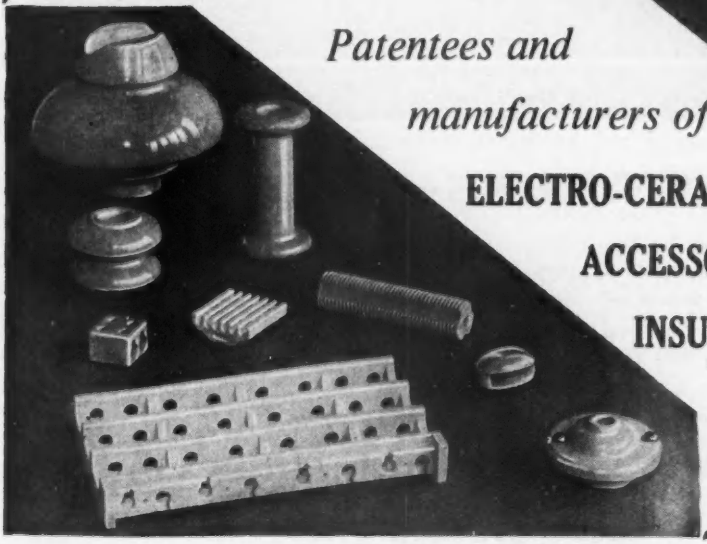

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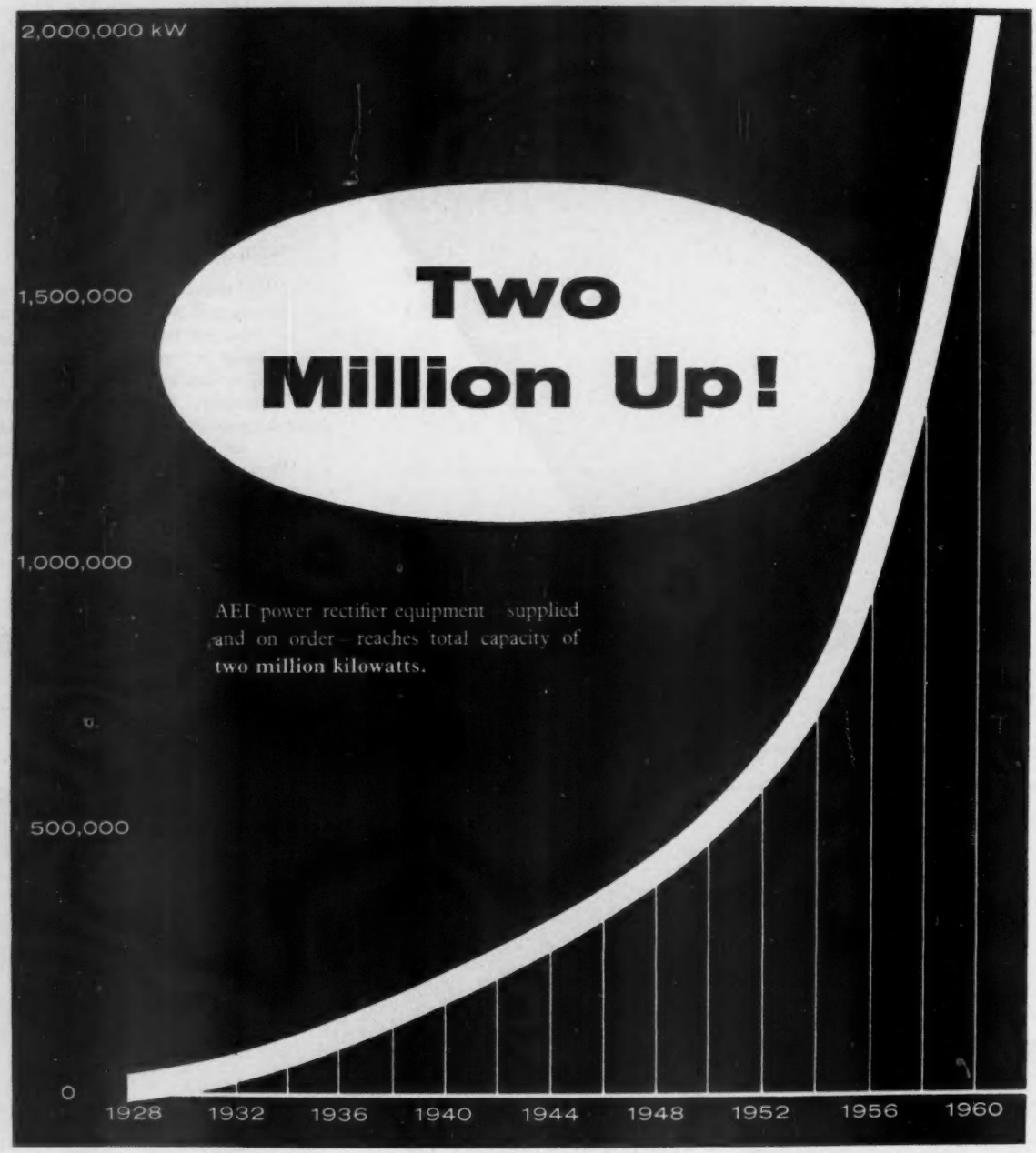

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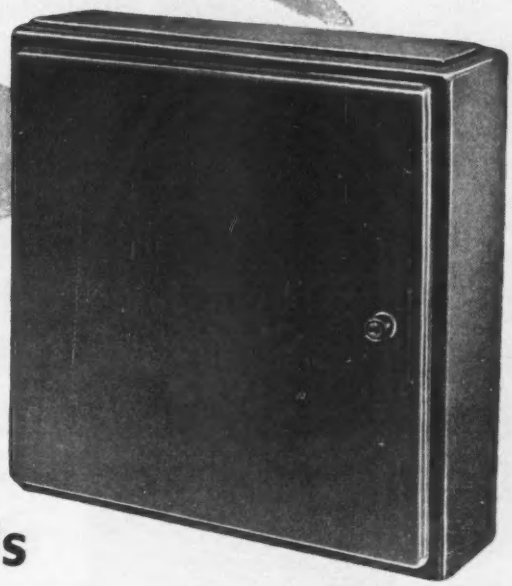

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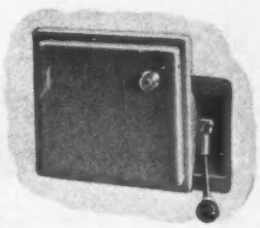

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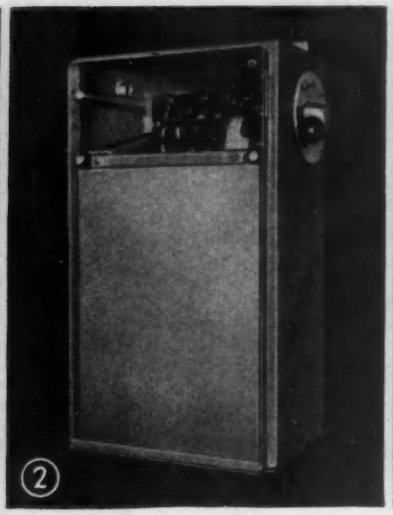

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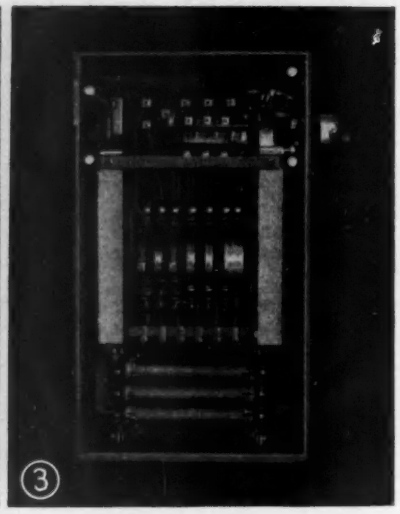

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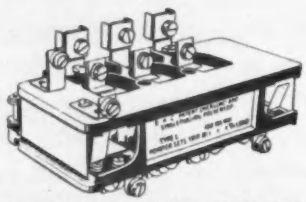

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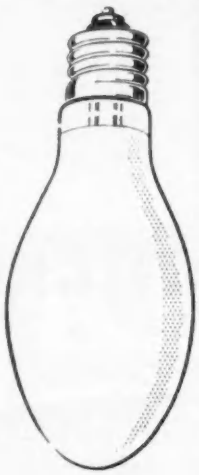

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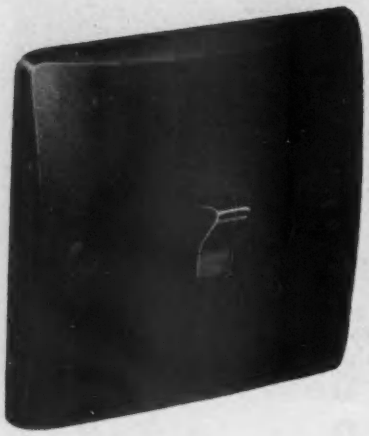

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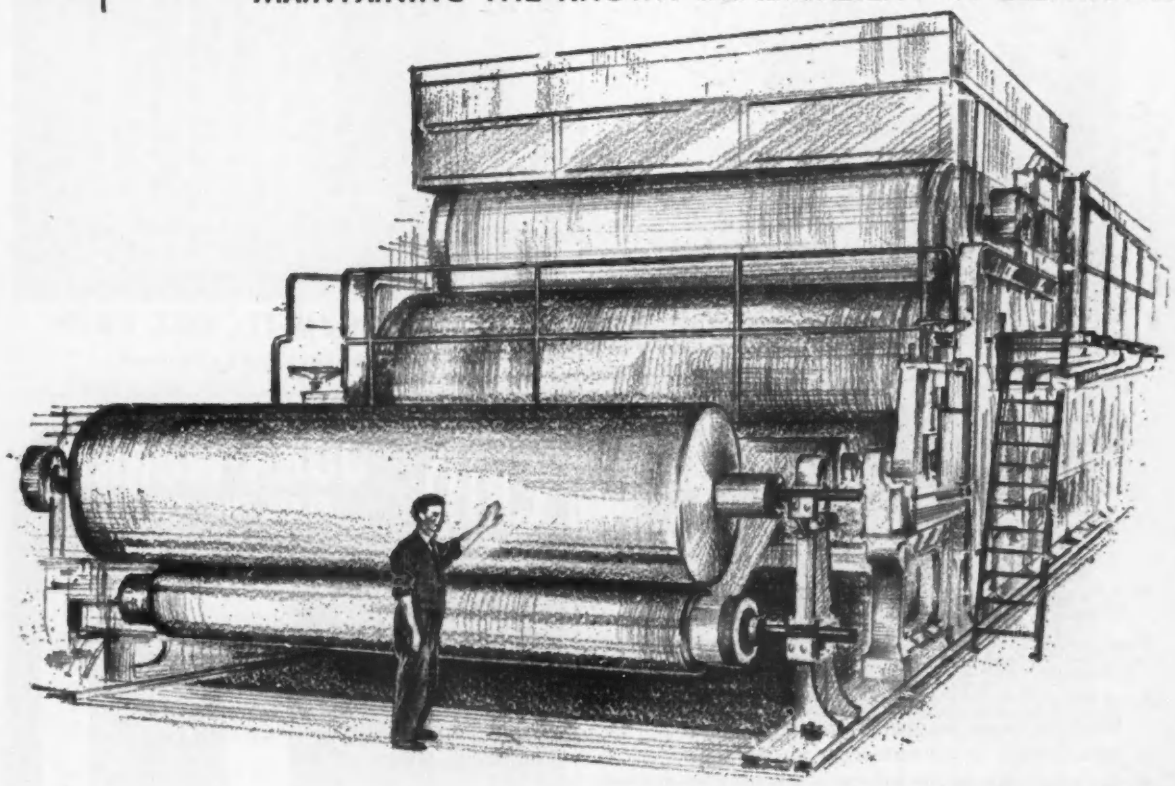

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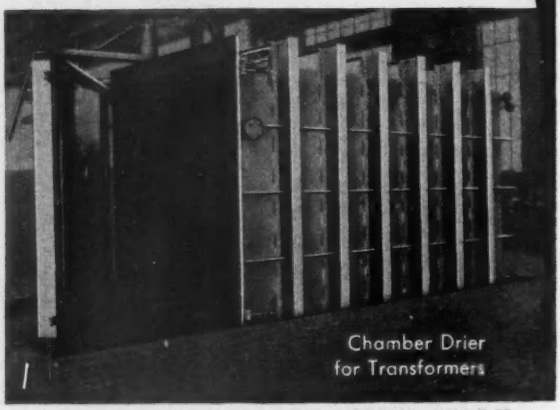

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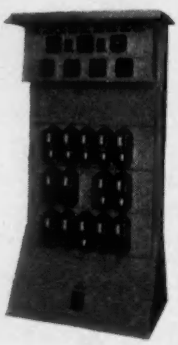

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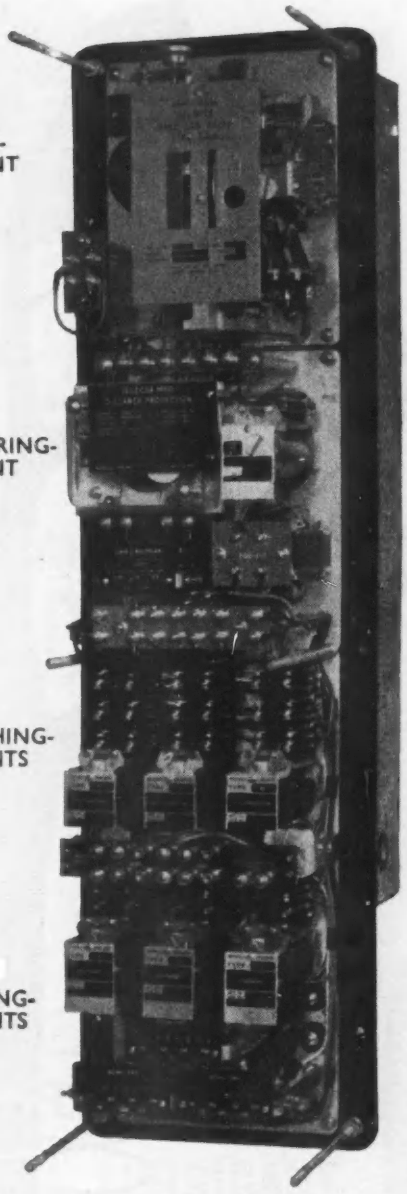

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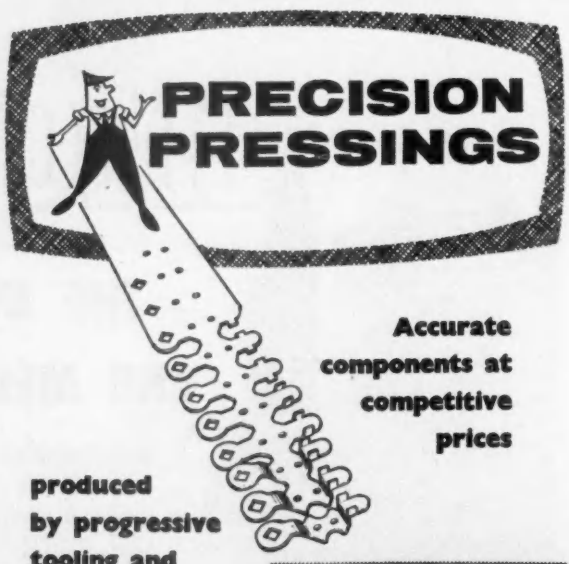

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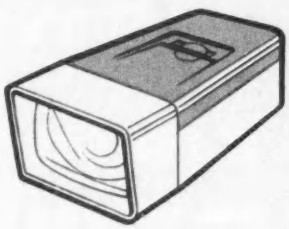

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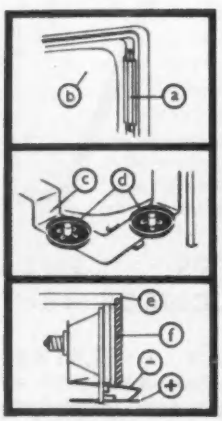

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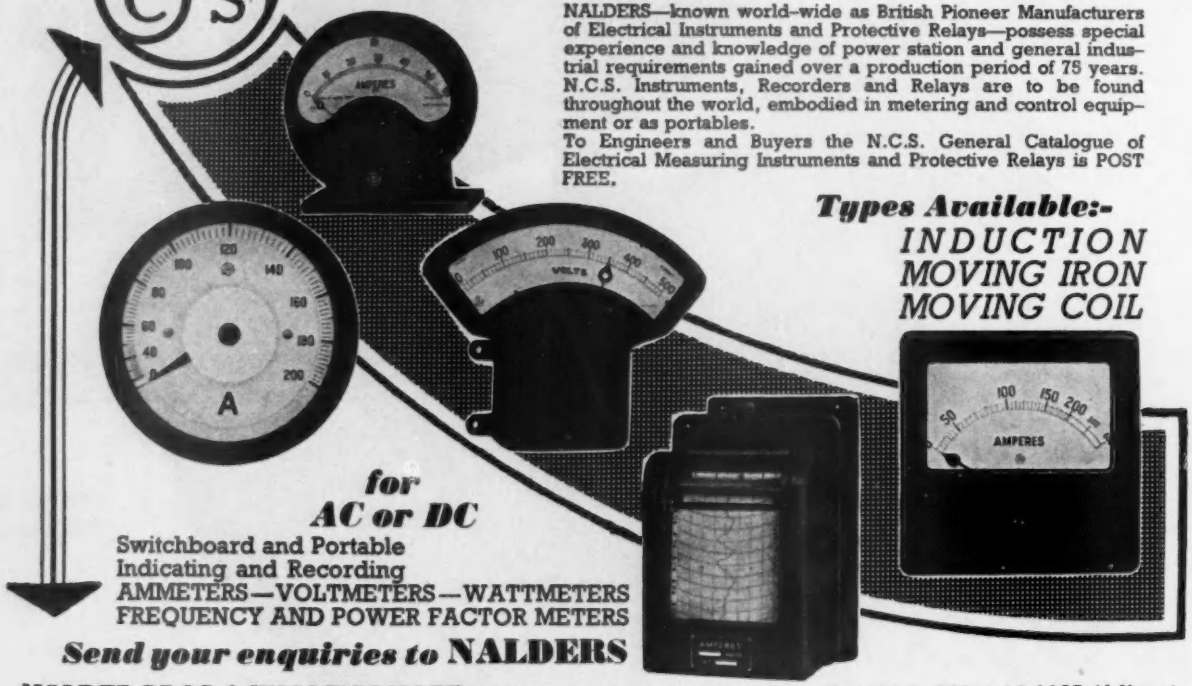

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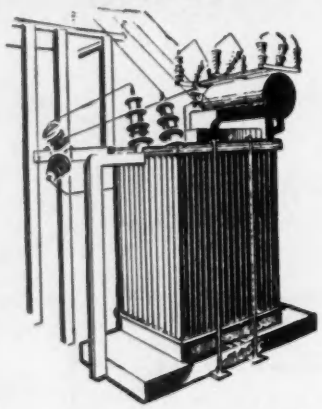

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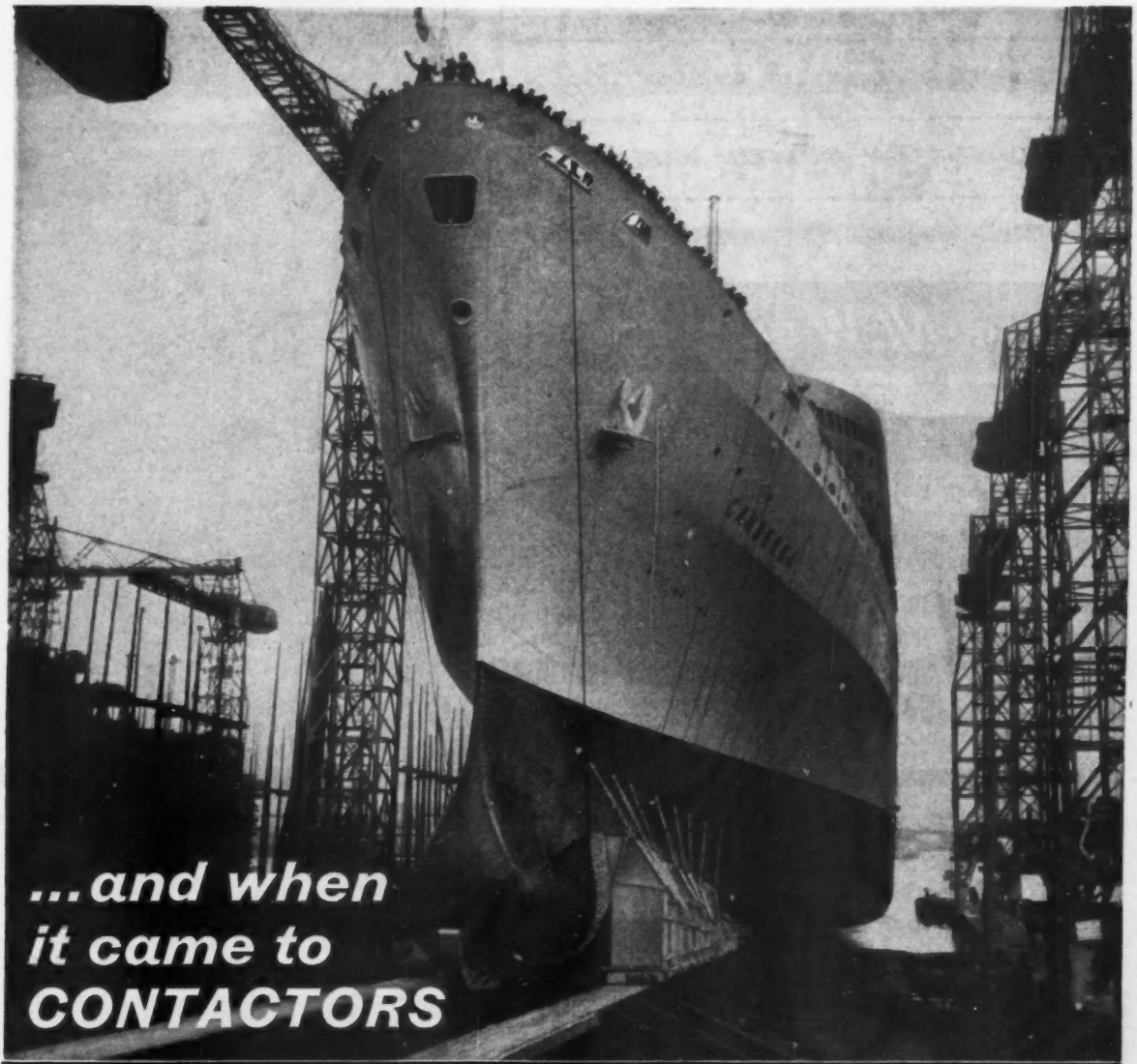

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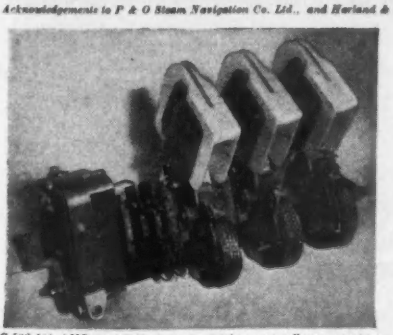

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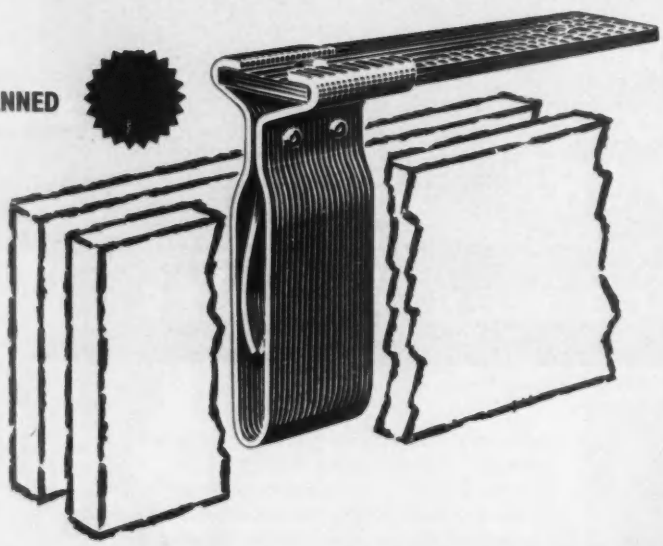

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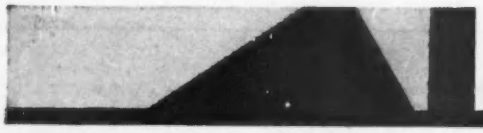

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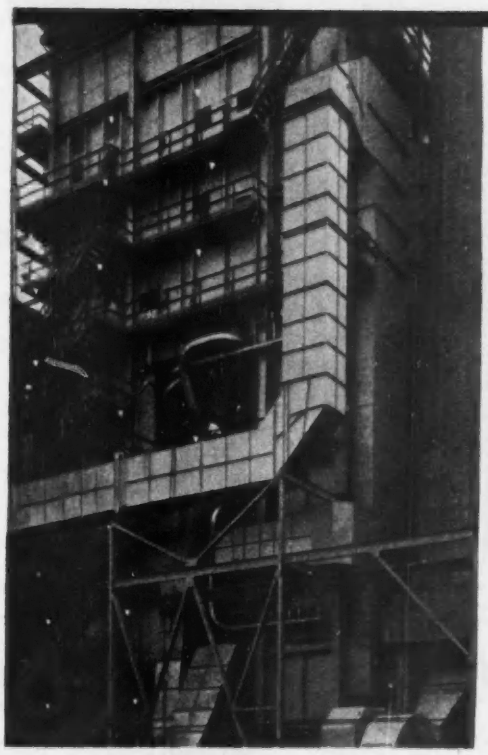

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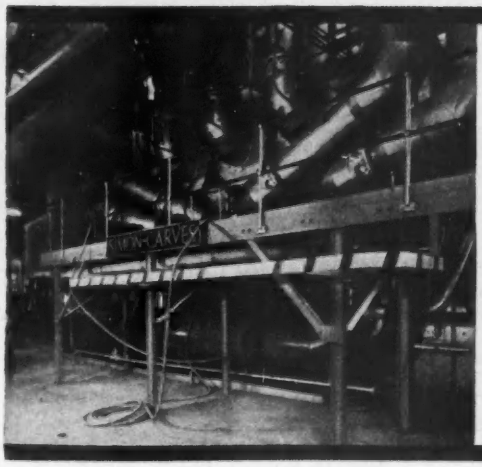

left. The operating front of the boiler is housed in the turbine building. Fuel can be blast furnace gas or fuel oil or a mixture of both.

right. The central control panel. From here, both the boiler and the high pressure turbines are controlled.

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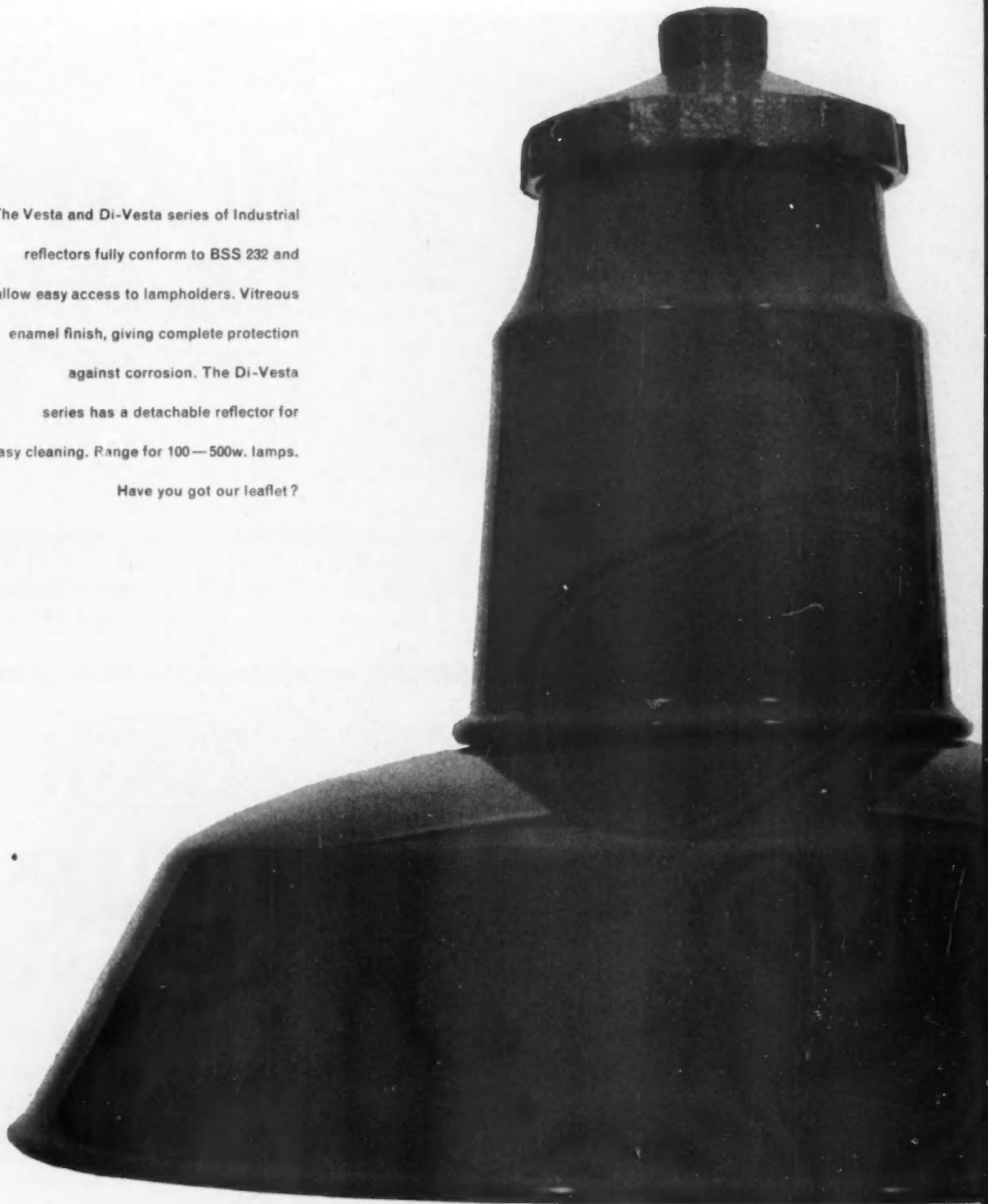

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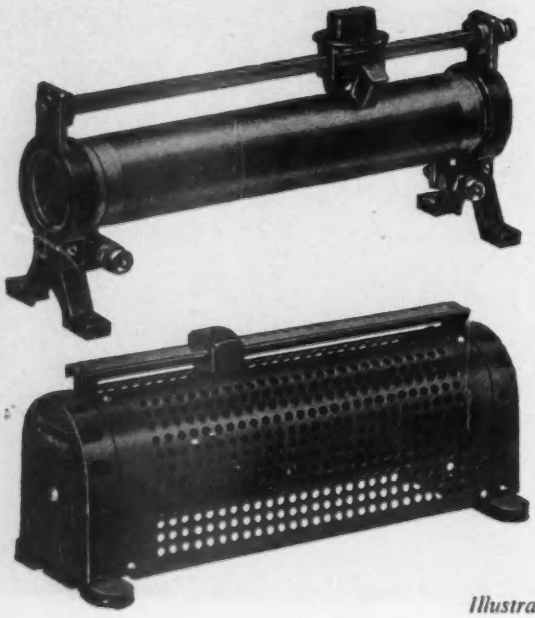

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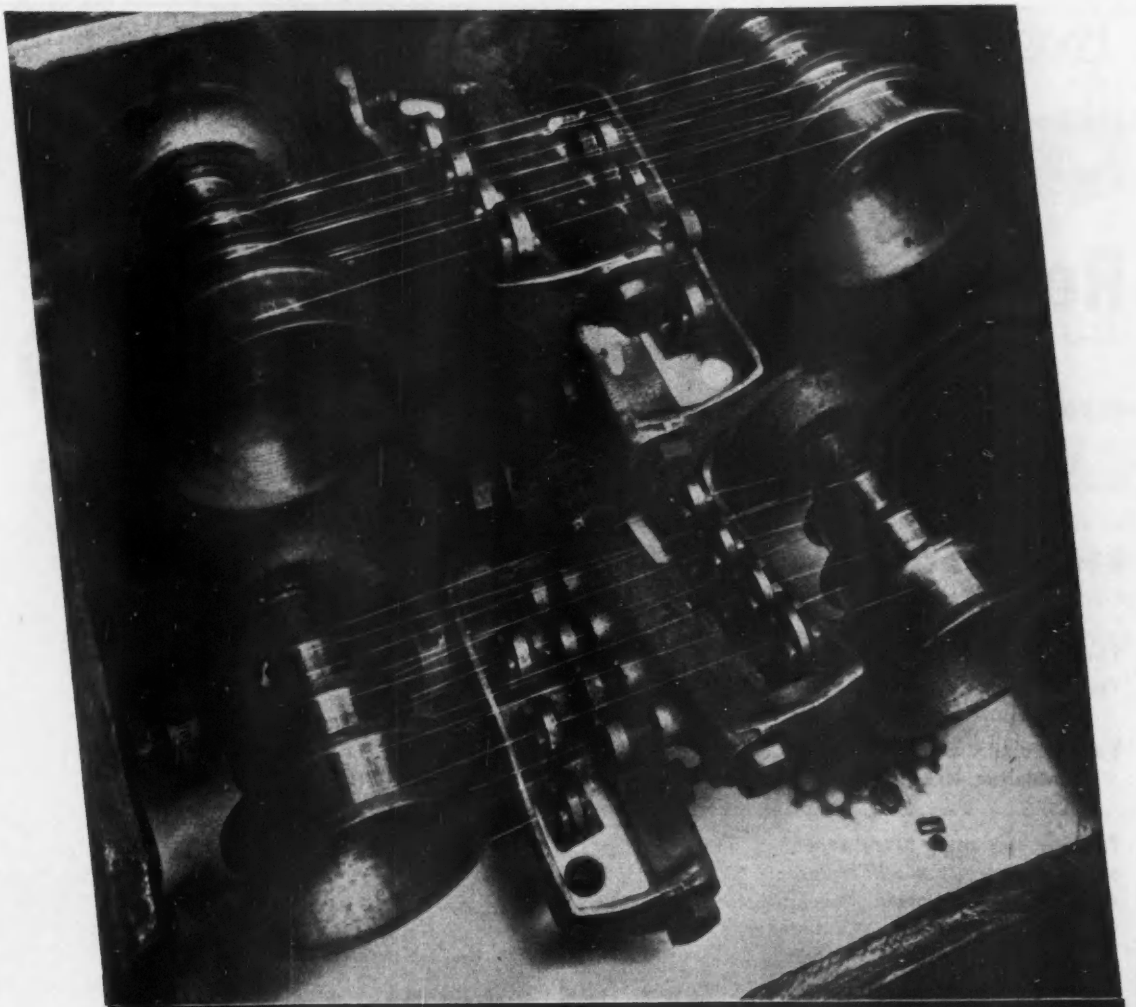

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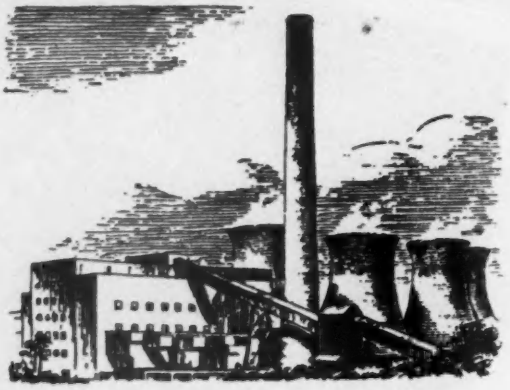

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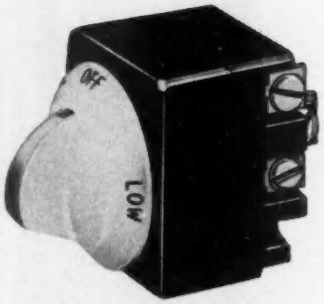

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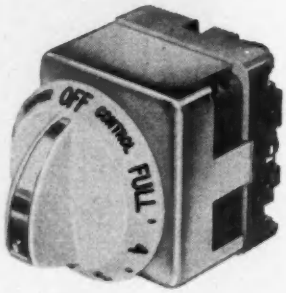

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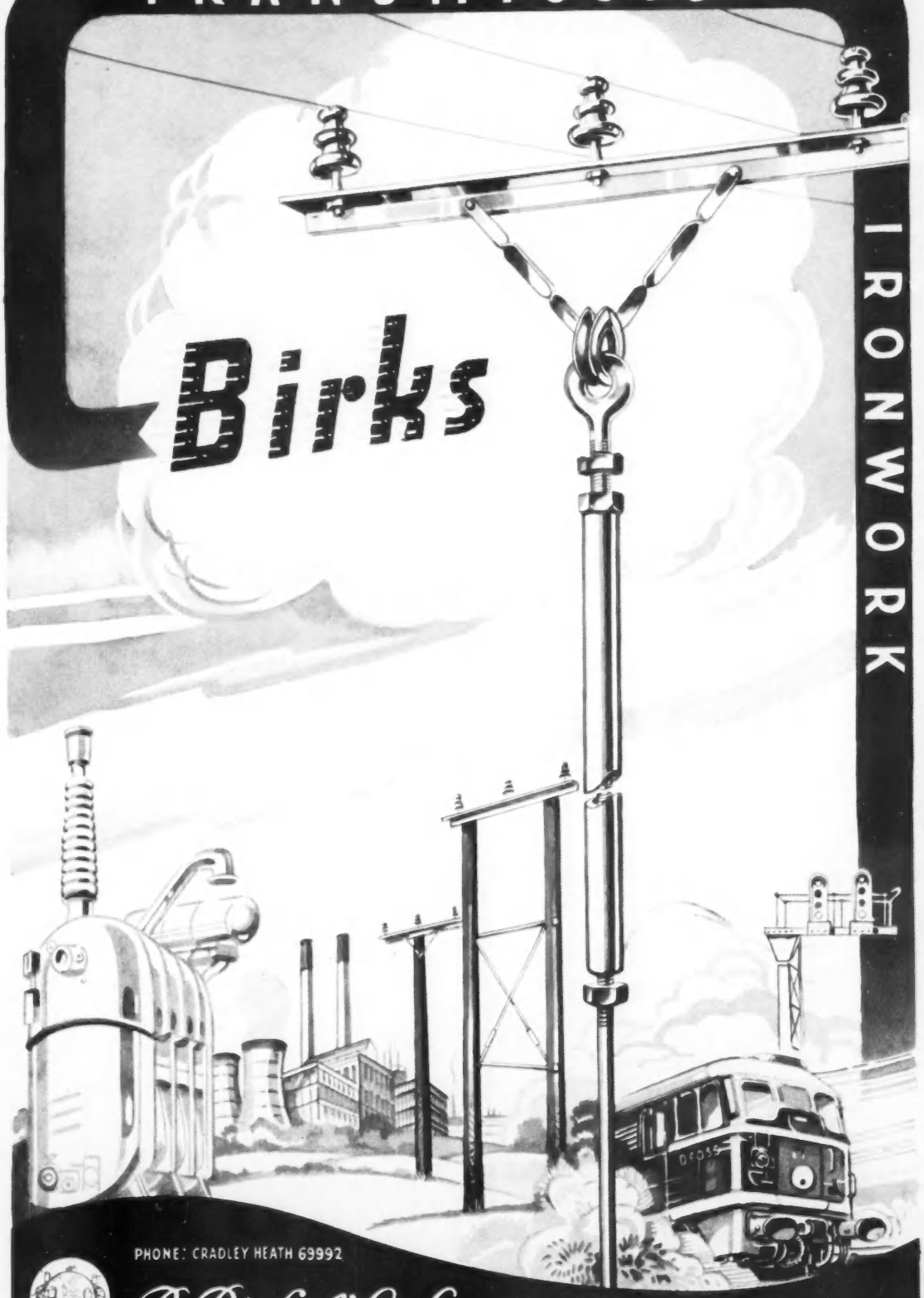

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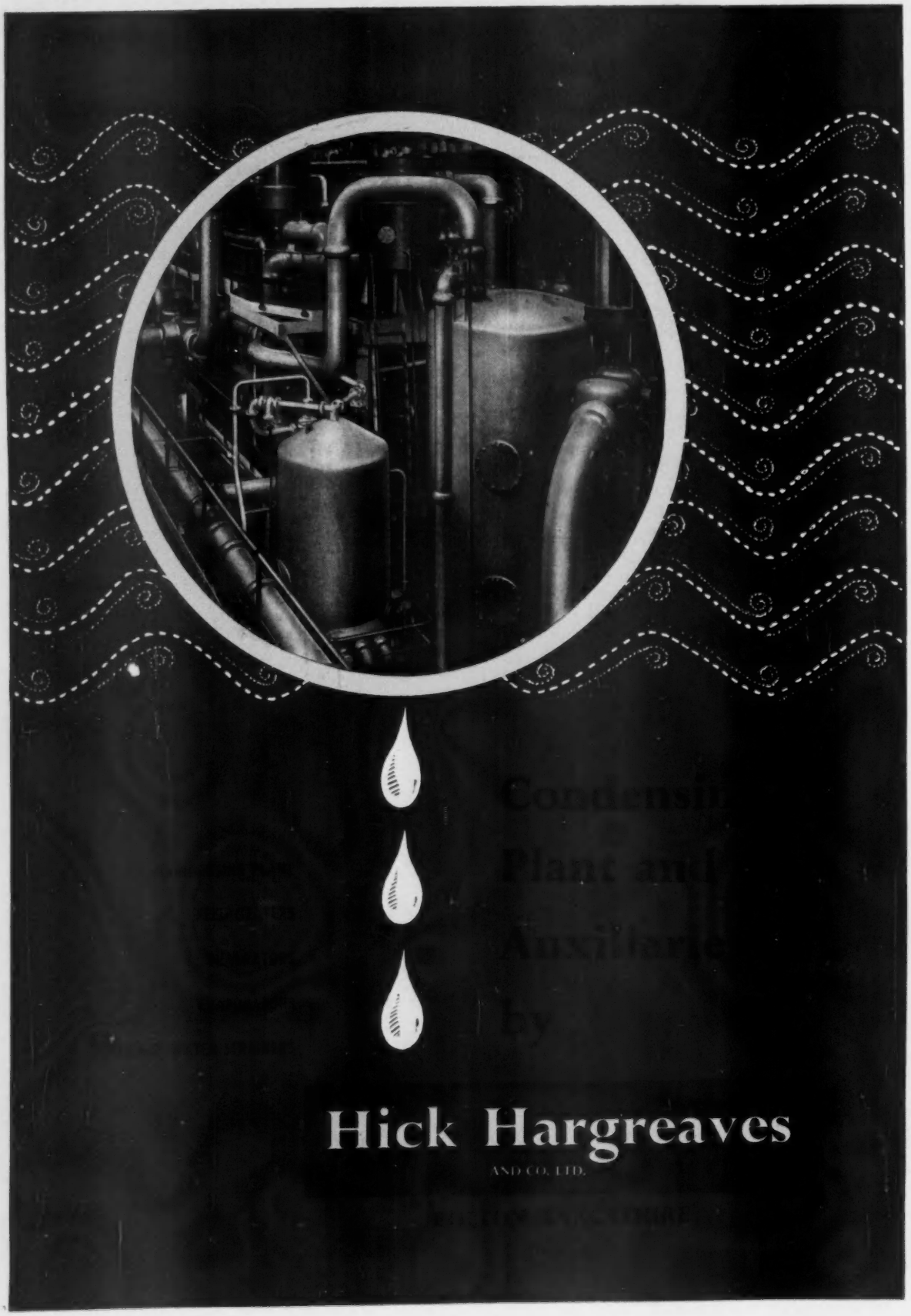
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